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Erecting Locomotive Frames and Cylinders.

BY V. HOOK.

The following plan is practiced in several railroad shops, in putting up, or "erecting" frames, cylinders, etc. The frames are planed together, and the four sides are trued up. The jaws being either planed, or slotted together, are certain to come right. The frames, after leaving the planer, are frequently drilled; that is, the holes having been laid out from the drawings, are then drilled under a drill press, instead of "ratcheting" them through, after the frames are up and boiler in place. The cylinders are generally drilled by ratchet after they are in place, and lined up. When the frames are on the trestles, the first move is to square them. There are numerous ways of doing this, however; here are a few: In Fig. 1, A, A, are the frames, top view B, B, B, B, the jaws sectionally. A straight edge C, is passed through the front jaws, bearing against the forward leg of the jaw. A large T square D is now placed on straight edge C, and the distances i j and o n made to agree. Of course the frames have been previously loosely bolted together, with distance pieces between them. Another plan is to draw two lines on the piece C, at h, h. These lines are the same distance from the same edge of C, one way, and at equal distances from the inside of the jaws the other, and of course intersect. A center g is erected, being an equal distance from the two inside edges of the frame. A tram is then placed with one leg at G, and the frames adjusted till the other point cuts the intersections of the lines at h, h. Still another plan is: From the inside edge of the forward jaw, measure any distance off toward the front end, as 1; square a line across the top of the frame, perform the same operation on the other frame. Place a T square E on the frame even and flush with one of the lines 1, and bring the opposite mark 1, by moving the opposite frame, flush with the same edge of the T square. I have seen some gang bosses use a large square, one blade laying on the outside of the forward and back jaws on one side, the other blade passing through the forward jaws, which were adjusted to the square by means of straight edge C. Fig. 2 shows A, A, end view of the forward legs of forward jaws, E, E, being a section of the frame. The jaws may be squared perpendicularly by two squares C and D, one leg of each being placed on the inside of the jaw and the long blades overlapping each other, K being the end of square C; others use a line G through the jaws centrally, and adjust by means of square B, and line G. The cylinders should be bolted together on the floor, and then placed on the frames. The faces of the saddle, y, z, (Fig. 1) being planed true with the bore of the cylinders, they should, when bolted together, tram the same distance from centers forward as they do at the back centers. If they do, they are soon placed in line by getting a line through each cylinder (each head being off as they should be in Fig. 1). The cylinder

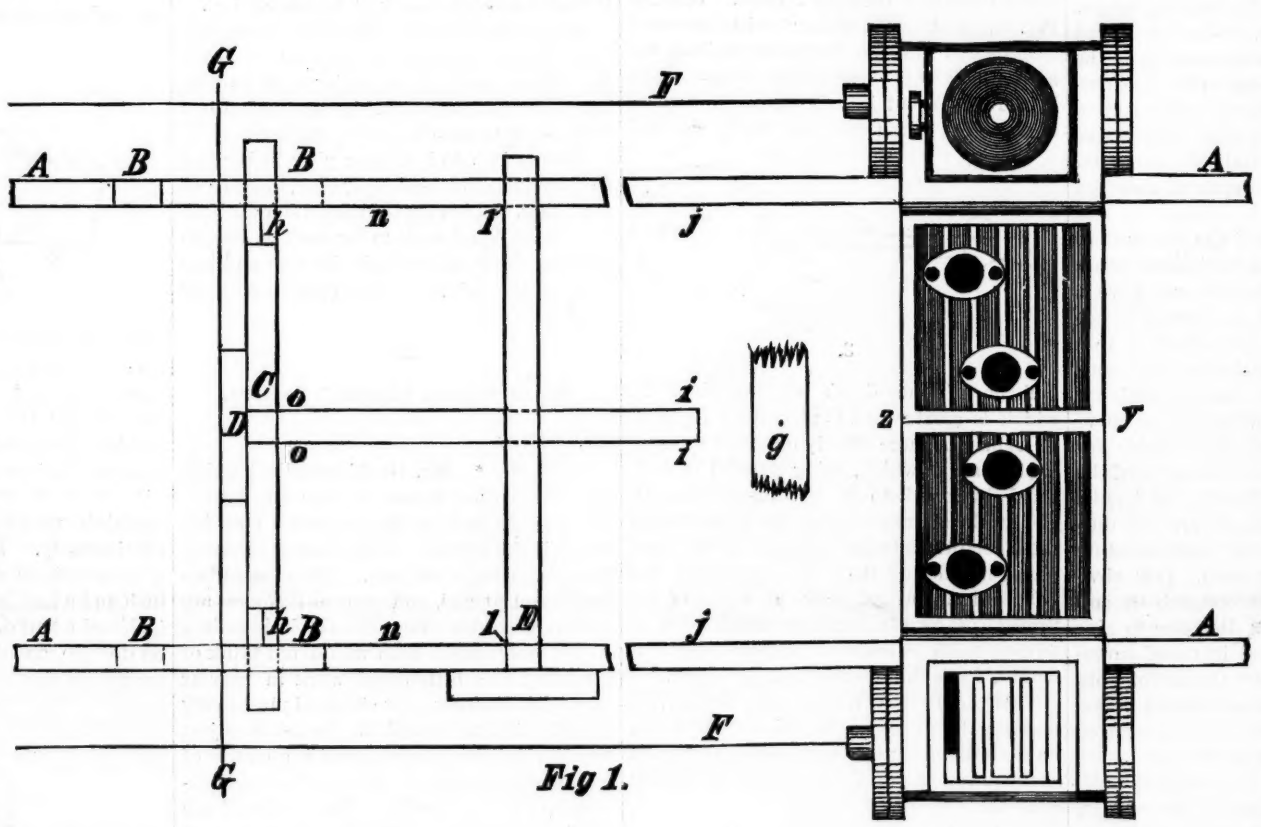


Fig 1.

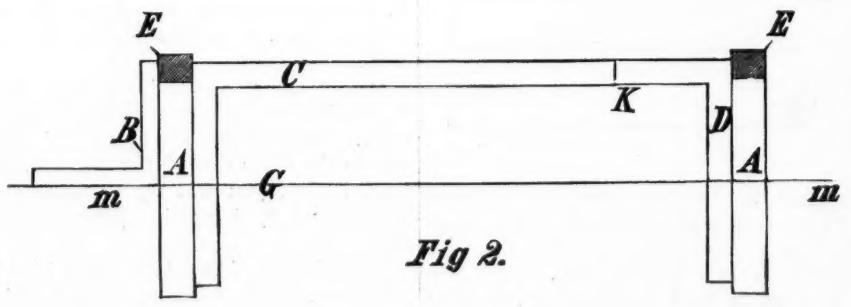


Fig 2.

line F, should intersect the line G, which represents the center of the forward driving axle, and it should be at the proper distance from the side of jaw, this distance being obtained from the chimneys, or (in case new cylinders are being put on to an old engine, and no drawing of same can be found) from the wheels and pins. In putting new cylinders on to old engines, the cylinder should be first bored out, then the valve seats planed, and lastly the flange, or lugs, for bolting the cylinder to the frame, which should be square with the valve seat. If the cylinders are horizontal, the face of the flange can be obtained by running a line fore and aft, past the centers of the jaws forward, and the distance either up or down to the cylinder seat on the frame obtained; the cylinder being bolted true by its bore to the planer bed, the distance with a surface gauge can be transferred to the flange, and planed up to it. If the cylinders are inclined, the face of the flange (that is, the distance from center of cylinder, either up or down to face of flange) can be obtained from the line as above, noting how much higher the forward end is than the back. The cylinder should, when this flange is planed, be bolted to the planer with the *back* end, as much higher than the forward from the planer bed as the forward is higher than the back, when in place on the engine, or in those proportions. After the cylinders are lined up they should be clamped in place, and the holes through the lugs drilled with a ratchet drill, unless the flange is in such a position as to render the use of a ratchet drill impossible.

Boiler Proportion and Construction—Tubes vs. Flues—Evaporative Power, Etc.

BY WM. H. HOFFMAN.

According to the recorded experience of a large number of American engineers, the contest between tubes and flues, as generally arranged in boilers where the heat passes *through* them, has thus far been decidedly in favor of the tubes when properly proportioned and located.

The construction of the tubular boiler, however, has often been inferior to that of the flue design.

The original idea of the tubular boiler was to fill a shell as nearly *half* full of *very* small tubes (say 1¼" diameter) as possible, and from actual compulsion. Locomotive engineers are even to-day building their boilers after this style, knowing, of course, that their main source of power lies in the artificial draught by the exhaust. Otherwise the small tubes would not only be inefficient in the amount of surface, but they would utterly fail to take the volume of hot gases through them, being simply wanting in area for natural draught.

The old-fashioned stationary tubular boilers soon showed their weak spots, *incrustation* was the death of this method of arranging tubes.

As the water in boilers becomes concentrated the order of disposition of the different salts therein is as follows: 1st, carbonate of lime; 2nd, sulphate of lime; 3d, salts of iron as basis or oxides; 4th, silica; 5th, common salt. Carbonate of lime considered as chalk, marble or limestone is held in solution in fresh water by an excess of carbonic acid, or it really is a bicarbonate; the acid is driven off by the heat, and the carbonate is precipitated. Sulphate of lime and carbonate of magnesia are also precipitated in all kinds of water, in fact, on becoming soluble, the lime and other salts remain in a partial state of suspension in the water, but gradually deposit themselves according to the density of the water.

Now, a *flue* boiler with the lower flues close together, and near the bottom of shell, is just as objectionable as far as the precipitation and deposit is concerned, as the old small tubular style. While the real danger from burning out, and explosion, is far greater than with the small tube system, and neither can be perfectly cleaned.

As to the evaporative power of each system when compared, take for example, a two flue, boiler 48" diameter, 24 feet long, 15" flues; now, take an old style tubular, same diameter, half filled with 2" tubes, 14 ft. long; now start with a sixty day trial, both boilers *clean*. The flue boiler at the first week's trial would evaporate 6½ lbs. of water with a pound of ordinary steaming coal, while the tubular would evaporate 8½ lbs. more water with one pound, same fuel. At the *last* week's trial the flue boiler will have fallen off to 5¾ lbs., but the tubular will fall as low as 7 lbs., both boilers being under the same conditions as to setting, draught, firing and feed water.

The loss in both cases being due to natural deposit of a poor conductor of heat on the most available heating surfaces, and when this deposit is removed it involves the laying off of these boilers for four or five days, and the cleaning is called finished when it can really only be imperfectly done. Now this all goes to prove—that *no* boiler should be termed economical that cannot be thoroughly cleaned whenever the fire reaches it, both *inside* and *outside*.

Most of the blast furnaces have sold all their product until next year.

Extracts from a New Book on Mechanical Manipulation.

BY JOSHUA ROSE, M. E.

No. 4.

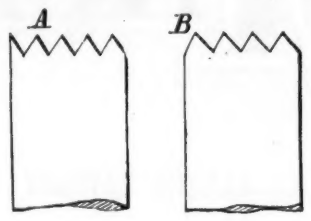
The chaser, which is sometimes termed a *screw tool*, or a *comb*, is employed to cut threads in a lathe. In Fig. 1 is shown an outside or male chaser, for cutting threads upon external surfaces. The width of a chaser should be such, in proportion to the pitch, as to leave a full tooth on each side; for if there is a half tooth, as shown in Fig. 2, its weakness will cause it to break off, and if it is on the front of the chaser, it will prevent the chaser from cutting a thread close up to a shoulder, or flange, on the work. Hence, in cutting up a chaser, it is necessary, after the first traverse, to examine if the teeth will be so located as to bring full teeth at the edges, or, at least, on the leading edge.

The teeth are cut upon a chaser, as shown in Fig. 3, in which A is a cylindrical piece of steel, having an external thread of the requisite pitch, and a series of longitudinal grooves to pin teeth having cutting edges. B represents the chaser, which is forced against rotating hob, A, while resting on the lathe hand rest, D, the teeth on the hob cutting grooves in the chaser, and causing it to traverse along the lathe rest. Successive traverses are thus taken until the teeth on the chaser are of the full depth of those on the hob.

It will be observed that if the chaser were held steadily in the same horizontal plane the length of the chaser teeth would have a curvature equal to that of the circumference of the hob, which, in the case of a very thin chaser, would be of no particular detriment; but, with the thickness of chaser suitable for all but the finest pitches of thread, the curve thus obtained would only be suitable for work of the same or of a less diameter of the hob, and, to avoid this difficulty, the handle end of the chaser is raised and lowered during each traverse, leaving but little curvature in the length of the chaser teeth. It is obvious that this end might be obtained by employing hobs of sufficient diameter to give the chaser teeth the desired degree of curvature, but this would involve the use of hobs of very large diameter, which would be expensive tools to make; hence it is preferred to move the chaser handle as described. To render the amount of this movement as small as possible, the top surface of the rest, D, should be so regulated for height, with relation to the hob, as to bring the top surface of the chaser horizontally level with the center of the hob, as denoted by the dotted line in Fig. 3. This will give the chaser teeth a curve in the necessary direction, it being noted that the chaser is cut upside down, or, in other words, the face of the chaser—shown laying on the rest in figure—is the top or cutting surface while the chaser is applied to cut a thread. After a chaser is cut on the hob, its edge, *c*, Fig. 4 (and the corresponding edge on the other side) should be rounded off so as not, when traversing along the rest, catch on any burr which may exist on the rest surface.

For use on wrought iron or steel the top face of the chaser should be hollowed out, as at B, Fig. 4, which will make it cut much more freely and clean. For use in cast iron the top face should be straight, as shown in figure, at A, while, for use on brass, tin, or other similarly soft metal (except copper), the top face must be ground off, as shown in Fig. 5.

The Pratt & Whitney Co. cut up chasers by the following method: In place of a hob, a milling cutter is made, having concentric rings instead of a thread, and is fluted as an ordinary milling cutter. The cutters are revolved on a milling machine in the ordinary manner. The chaser is fastened in a chuck fixed on the milling machine table, and stands at an angle of about ten degrees. It is traversed beneath the milling cutter, and thus cut up with teeth whose lengths are at a right angle to the top and bottom faces of the chaser; hence the planes of the length of the teeth are not in the same plane as that of the grooves of the thread to be cut. Thus let *a*, *b*, *c* and *d*, Fig. 6, represent the planes of the thread on the work, and *e*, *f*, *g*, *h* will be the planes of the lengths of the chaser teeth.



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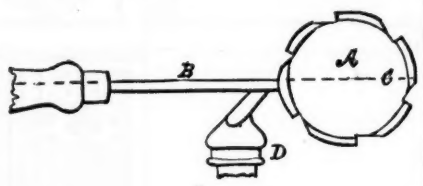
But the 10 degrees of angle, already referred to, serve to give the chaser teeth clearance from the sides of the thread on the work, as is shown in Fig. 7.

Now, suppose the top face, A, of the chaser to be parallel with the faces, B and C, of the tool steel, and to lay truly horizontal and in the same plane as the center of the work. This clearance will cause the thread cut by the chaser to be deeper than the natural depth of the chaser teeth. Thus, in Fig. 8, is shown a chaser (with increased clearance to illustrate the point desired), the natural depth of whose thread is represented by the line D, but it is shown on the section of work, W, that the thread cut by the tool



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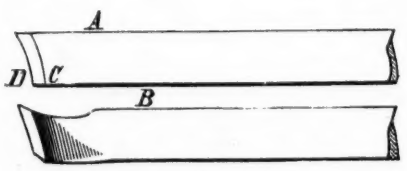
will be of the depth of the line, E, which is greater than the length or depth of D, as may be more clearly observed by making a line F, which, being parallel to A, is equal in length to E, but longer than D. Hence, the clearance causes the chaser under these conditions to cut a thread of the same pitch, but deeper than the grooves of the hob, and this would alter the angles of the thread as shown in Fig. 9, in which each alternate tooth is made of different depth or height, while the pitches of all are equal.

This the Pratt & Whitney Co. obviate, by making the angles on the sides of the teeth, on the milling cutter, vary sufficiently from the required angles of the sides of the thread



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to be cut, to cause the chaser to cut a thread of the correct angle and depth when the face A of the tool is horizontal, and in the same plane as the center of the work.

* * * A hand chaser should, to avoid this source of error, be placed with its top face slightly above the horizontal center of the work, and held quite horizontal; and the handle end then elevated, just sufficient to give the teeth clearance enough to enable it to cut—otherwise with a chaser having top rake the thread cut will be too deep, and its sides will be of improper angle, one to the other. Thus in Fig. 10 W represents a piece of work, R, the lathe rest, and T, the chaser. The depth of the thread cut in this case will

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be from the circle A to the circle B, whereas the proper depth of the thread is from C to D. Thus, tilting the handle end too much has caused the chaser teeth to cut a thread deeper than themselves. If, on brass work, the chaser have its top face ground off, as in Fig. 10½, tilting the handle too much will cause the thread cut to be too shallow, and in both cases the error in thread depth induces a corresponding error in the angles of the sides of the thread, one to the other, and relative to the axial line of the work.

* * * The teeth of a chaser should be at a slight angle with the edges of the steel, so that if the chaser be set parallel with the surface of the blank work, as in Fig. 11, or (if the lathe have a compound rest so that the chaser can be moved laterally) parallel to the tops of the thread as in Fig. 12, the leading edge of the chaser will clear A, a radial face on the work, as shown in Fig. 13. But the chaser teeth, must, in any event, be set parallel with the surface of the work, and not with its axial line for the following reasons:

If the chaser is held at an angle to the work surface, as shown magnified in Fig. 14, the thread cut will be of finer pitch than the chaser, and the angles of the sides of the thread on the work will not be the same as those of the teeth, as is obvious from the illustration. It is presumable, however, during the early cuts taken with a hand chaser to give the chaser a slight degree of such angle, because it diminishes the length of cutting edge, and causes the chaser to cut more freely, especially when the pitch of the thread is coarse and the chaser is becoming dull.

In the case of a tape thread the same rule (that the thread may be roughed out with the chaser teeth at an angle to the surface lengthways) of the work, but must be finished with the teeth parallel to the surface.

Thus in Fig. 15 is a taper plug fitting in a ring having a threaded taper bore, the threads matching, and having the thread sides in both cases at an equal angle to the surface, lengthways of the work, though the tops and bottoms of the thread are not parallel with the axial line of the work.

Extracts from Chordal's Letters.

Mr. Editor:

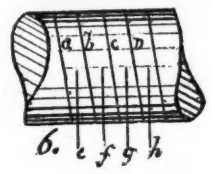
* * * * Mr. Hook's excellent article on small coring in one of your late issues, led me into looking deeper into a plan followed in the foundry of the Cope & Maxwell Manufacturing Company. They manufacture steam pumps, and some of the cores are of that character which Mr. Hook describes. A few years ago a man would not think of involving this little cored work in regular every day business. It stumped most every moulder who undertook it. In the shop just referred to they keep on hand a quantity of wire made of beeswax. Size varies from one-sixteenth to one-eighth. The "wires" are laid in the core as it is rammed up, just as V. Hook's vent strings are. When the core is baked the wax runs out leaving the vents clear.

* * * * "Greaser," you have dared to criticise those who harp on the dignity of labor. You should not do it. Commit yourself to the other side of the question, and then, maybe, you will try to make your words good by improving your surroundings.

Your foreman is a very common kind of a foreman, but there is a way of curing him. The first time he ever opens his head to damn a boy or man, let that man or boy hit him with a monkey wrench, or most anything else, and a change will be effected at once. If the man has the proper stuff in him, he will learn that there are other and better ways of doing things; if he is a dog, he will clear out. In either case the men's position will be rendered more pleasant, and the shop will profit by increased value received from the men. It's a hard remedy, but it's a hard case.

* * * * I really think it a good plan for workmen to make shops too hot to hold these coarse-grained foremen. No proprietor in the land ever changed from a pirate to a gentlemen without finding his costs reduced.

Tubal had a foreman who could not possibly disapprove without insulting. He ought to have known better, because every man should know that friends are desirable and enemies not. Still this fellow could not help it. There was not a man in the shop in sympathy with him. Every man looked upon him as a man to be shunned and thwarted. He knew nothing of what was going on, and could do no real execution. The men muttered and drew their pay and worked as little as possible. Tubal found himself almost driven from the market by the high cost of his work, so he kept dinging at the foreman, who told him the men were bad. Tubal let him go and got Jimmy in his place. Jimmy went into the shop, and without discharging a man, cut down



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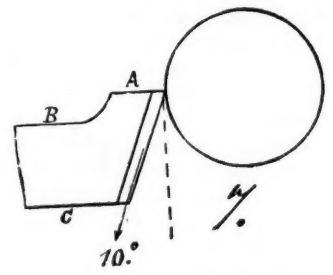
the costs twenty per cent., by simply increasing the good feeling of the men.

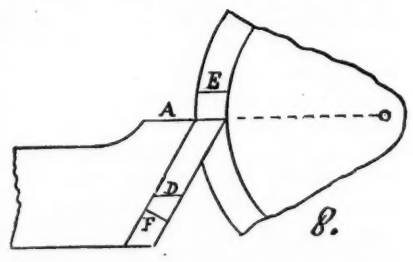
* * * * It certainly does not pay to work men who have to be eternally and forever cursed into their work, and it is certainly as true that it don't pay to follow such a course with men who don't need it. The dollar and cent. view will take the big, big D out of the shop.

* * * * If a good man does a bad job or breaks something, he is ashamed of himself



and will remember. A foreman should be smart enough to appreciate this side of human nature and act accordingly. Let him assume that the man don't care, and begin to blast him, and the man will never care again as long as he works for that foreman.

* * * * There is a certain species of machinist who makes mistakes—always and continuously. His ten feet four inches and a quarter is an eighth short or long. His inch and a half is in the neighborhood of an inch and a half only. He forgets the washer on this job, and don't cut the thread up far enough on that one. He drills this hole too



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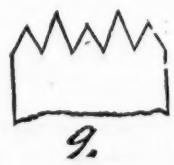
far from the edge of a flange, and drills that tap-hole the size of the outside of the tap, and he never gets a hole the right size for a tap, and he never chucks a job true enough, and he sets a lathe over so as to turn a crowning pulley very much more tapering on one side than on the other; he won't make a key bear on the sides, and no wrench will fit all round on the bolt-head he files up; he taps holes crooked and runs pipe traps in too deep; he cuts shoulders up a sixteenth too far and makes the driving fit on the wrong part of the job. He is a good workman, for all these things are nicely done. He simply



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forgets, or neglects, or something or other, and is an infernal nuisance, for you never can depend on him. When he lays a job down you never can have the assurance that it is right until you measure every thing about it. The work that such a man does costs lots of money, because you must provide a special supervision over every thing he does. Such a man will turn a foreman's hair gray if he lets him keep on. He never will get any better as long as he works in the

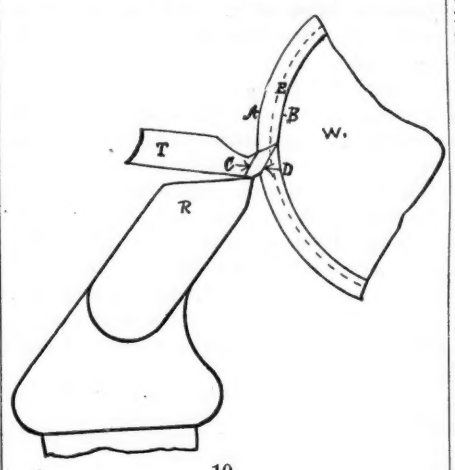
same position. To cure this man, reduce his pay and put him at the very foot of the ladder, telling him to raise his own pay by learning to be "sure." No men continually liable to small mistakes around me, if you please.

* * * * Another species works decisively and surely. When he goes for a size he gets it as close as the case calls for. He don't slouch dimensions. You never think of running over his sizes. You know they are what you ordered, but—once in six months this man will make some grand blunder. He will turn something to eleven and a half inches which should be twelve and a half inches, but that eleven and a half inches will be a good and accurate size. He will get an engine four inches out of line, but he will never get it a sixteenth out of line. He will try to raise a smoke stack under one of his guy ropes, but his rope will not be a foot too short. He will get things right wrong and fit up his steam pipe out of one inch pipe and make his feed pipe out of four inch pipe. He will cut a wide rubber belt four feet too short, but never four inches.

He will get on his two-thread gears to cut fourteen to the inch, but he will never get the fifteen-thread gears on. He will bore the taper hole in a piston wrong end to, but it will be a good hole and the right size. He will leave a monkey wrench inside of a steam cylinder when he puts the head on, but he won't leave any small stuff in there. He will do one of these outrageous things two or three times a year, and one of these blunders never teaches him to guard against the next. Between blunders, the blunderer is invariably all right. You can depend upon him. His blunders are so obvious that they will not pass into misfits. The blunderer never makes little mistakes and the chronic "mistaker" never reaches the dignity of the blunderer. Give me the blunderer every time.

* * * * Another man is awfully cautious, careful and sure. It is painful to watch him. He calipers a fit, turns his work nearly to size, hesitates, doubts, and goes through the whole calipering process again. When done he will ache for a chance to try his work to see how it will fit. He measures everything twice and then ain't sure about it. These anxious men are never sure of anything. The more pains they take to assure themselves, the less sure they are. They have no confidence in themselves. No decision, no boldness. The thing grows on them and they grope their way through life. When he locks up his tool box at night he must always go back and put the key in the lock to see whether he locked it or not.

* * * * Another kind of a chip is the man who never becomes so preoccupied with a thing that he doubts details. He is a man of bold and decided action. He has self confidence enhanced by self confidence. Watch him caliper a job. He knocks his inside calipers with a motion that means something. They move an inch each blow. The last hard blow is lighter, but decisive. Then come the gentle strokes, soft and delicate, but effective. Finally, he gets the fit, and when he does he leaves instanter. He has got all he came after. He goes to his lathe and sets his inside calipers, and when he gets them right he stops trying to see if they are right; he knows they are. Then he tries the job in the lathe. Good deal to come off. He gives the crank a pronounced turn and takes a big cut over the job. Does he hold his calipers in his hand and think about the fit in the mean time? Not a bit of it. He starts his new cut, tries his calipers, and sees that he has the right size; lays the calipers down, and lets her go. His mind is now free. He don't wonder if his job is the size of his outsides; he don't wonder if his outsides are the size of the insides; he don't wonder if the insides are the size of the hole; he don't wonder if the feed in the hole was just about right; he don't wonder about anything. He *knows* what he has done. He will follow up his job with his calipers, and keep the thing turning straight, and, when done, he will lay the job aside, and don't care a cent who the first man is to try his work together. He don't know what relief is, because he don't know what anxiety is. There is no luck, or ill-luck, in the universe for him. A man who makes caliper fits with confidence holds the universe in his hands, and shapes his future with effective strokes. When he raises a sledge hammer,



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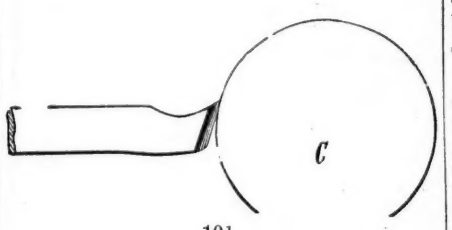
he hits where he intends to. He don't wonder where that hammer is coming down.

* * * * Another machinist is the mullet head. You call him a machinist, and he calls himself one, because he has worked at the trade about fifteen years. He has no skill, no pride, no taste, no knowledge, no judgment, no nothing.

He is too obtuse to reason with. He will do what you want done, if you can hammer it into his head what you want. If you can't do that, you had better give him some other job. He has no pride to shame, so there is no use talking to him. Inert matter becomes sentient and independent in this man's hands. You may pick out a three-quarter drill for him, but, sure as Fate, it will drill a thirteen-sixteenth's hole. He is stupid and ignorant, and that is all there is to it. If you set him



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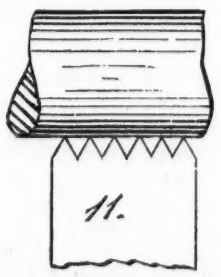
to turning a grindstone, you must fix a ratchet on it, or it will be as apt to turn one way as the other.

This is the fellow who makes a swearing man of your Sunday school superintendent. Swearing at such a man is a waste of talent. It ruins the swearer, and has no effect on the swearee. The man is out of place, and has chosen the wrong trade. Find a job more suitable for his abilities, such as tightening up fish bolts on a railroad. You can do nothing with such labor around a shop. If you pay him money enough to just support him in his mean, unambitious way, he still cannot give you value received.

* * * * Of all the bad things in the shop, the worst is the "clique." Workmen, foremen, superintendents, managers and pro-



prietors, feel its baleful influence. There is but one way to circumvent a "clique" and that is to stamp out every man composing it. If you are superintendent, you owe it to your employer to see that no lack of unity exists, as far as your position is concerned. Use your authority justly and firmly. Give shelter to no vipers, and don't handle thistles with a tender hand. If there is an influence or an atmosphere which fails to co-operate with you in your duty, which clogs every movement you make, or which submits slavishly to fate, purify the thing at once. You fail in your duty to your superiors, if you permit the thing for any reason whatsoever. Put the question fairly, and discharge every man who hangs a lip. If one of the members of the "clique" is your superior, state your case to him and draw your pay. Be king; be a good king, deserve loyalty, and remove all disloyal influences.

* * * * I am studying about what kind of benches to put into the new North shop. I am sick of the usual things; they are too convenient to throw things under for one thing, and I have about made up my mind to have them wainscoted, or sealed up, letting the bottom of the "sealing" drop back, say eight inches. The benches gotten up by Brown & Sharpe, and sold by them, are the neatest I have ever seen, and look as though they had been studied over. I am prejudiced against drawers in benches. Our men will pile files in them, and do the files more damage than their regular use. Then they will throw in chipping chisels and hammers and wrenches and squares and soap and scrap iron and scrap brass and odd pipe fittings and sausages and sheet rubber, and I don't know what all I am studying on a wall cupboard to take the place of the drawers and if I succeed in getting up anything to suit my ideas of the proper thing, you shall hear of it. While I was visiting the shop of Brown & Sharpe, I mentioned my objections to drawers, and Mr. Viall, the superintendent, got the keys from the men and we made the grand rounds. Yale locks to start on. Think of that, you who use padlocks and drawers that you could actually draw right open without any hammering or fussing. And when those drawers were opened they looked as nice and clean inside as any apprentice's tool box. Here a neat clean sliding tray for scales and calipers and small tools generally; here a division for chisels, and here another one for files. These drawers didn't remind me of anything I had ever seen in a machine shop before, nor the men at work in the shop didn't either.

If they would let Wykoff have those drawers about a week they would not recog nize them and would not want them back again. Oh, if I was only an artist, wouldn't I like to send you an interior view of one of Wykoff's bench drawers, just to show some of the boys the difference between machinists and machinists. * * * *

Very respectfully,

CHORDAL.

A Nation Without Iron.

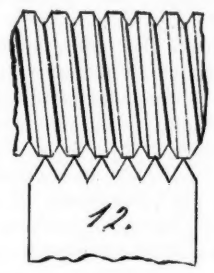
Mr. A. Woeikof, in a narrative of his travels in Yucatan and the southeastern States of Mexico, published in Peterman's *Mittheilungen*, introduces us to a so-called "civilized" people, who are practically unacquainted with the uses of iron. Writing about the northern portion of the State of Chiapas, he says that the inhabitants employ iron only in the shape of axes and machetes, which are imported from the United States. For the distance of 100 kilometers round about Pallenque, not one blacksmith is to be found. Not a single nail is to be seen in their houses; everything is held together with cords or with vines. Even in the preparation of their usual article of food—tortillas—the apparatus they employ is equally primitive, though in this respect they follow the custom which is universal throughout all Mexico and Central America. The grains of maize are crushed between two stones, one of which, the nether one, is rather large, with a sloping upper surface. A woman kneels by this stone and strews upon it some grains of maize. The coarse meal so obtained is baked into flat tortilla-cakes in the ashes. This is exactly the mode of preparing meal in vogue in Central and South Africa; the African negroes, however, show a higher grade of culture, inasmuch as they understand the working of iron. Our author caustically remarks, hereupon, that "the introduction even of hand mills would be for this country, a step of progress of far more value than many a high-sounding political prerogative, which can never be of any advantage to a population living in so low a grade of civilization."

PASSAIC, N.J., Oct. 22, '79.

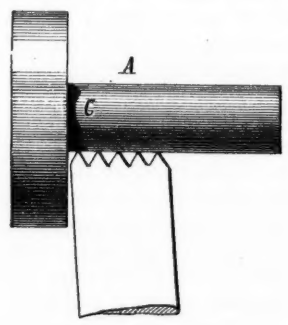
Editor American Machinist:

In the MACHINIST of November 1st, I note criticism on my article on Steel Bolts and Tapping Cast Iron in Constructing and Assembling Steam Engines, by Mr. Robert Ramsay.

Some of us mortals are very unfortunate. Take my own case, for instance. Living in New Jersey, outside of the United States, I



have never, until informed by Mr. R., been aware that the only thing to be considered in using steel bolts, is the matter of *wear*. I always supposed that strength, perfection of thread, economy in labor, breakage of taps, &c., had something to do with the subject mentioned. We can buy nuts "in these parts" for less than it costs to drill and tap cast iron. In regard to cylinder head bolts, I will only say, that in this country (New Jersey), we cover all our steam engine cylinders with



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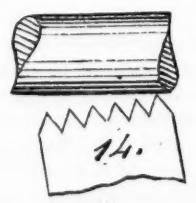
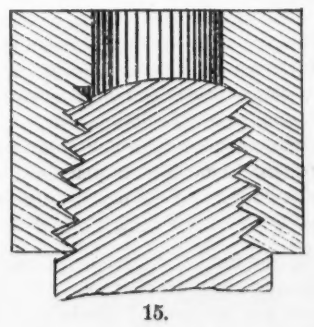
laggings of wood, brass, or iron, *all* bolt heads being entirely hidden from view. If Mr. Ramsay has found even *one* suggestion in my article worth noticing, I am satisfied.

An article in same Number refers to my letter on Proportion, of Aug. 30th. I wish the writer had signed his name; however, if he will consider the matter with care, he will see that I wished to notice (when speaking of fuel as of little or no account), only those en-



gines fitted with *one* plain D slide valve, with lap about one-half the width of *port*, *no* cut-off on its back. There are hundreds of them running to-day.

WM. H. HOFFMAN.



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We were informed by a working machinist, the other day, that workmen of all classes were in demand in the machine shops of this city. He had during two days been offered thirteen different jobs, all promising fair wages. That looks like a boom.—*Journal of Industry*, Pittsburgh.

A Substitute for an Equilibrium Slide Valve.

BY F. G. WOODWARD.

An article, in your issue of Aug. 30, upon the subject of steam engine valves, induces me to offer you a few words upon the same subject. Not less than fifty attempts have been made, by about as many different inventors, within twenty-five years, to produce a practical "balance slide valve"; and probably there have been many which have escaped my notice, and of which there has been no record.

But it seems that effort in this direction has not been productive of very satisfactory results. It is true that equilibrium devices have been applied to the slide valves of some marine engines with partial success, but they are complex and leaky and unreliable. The puppet, or lift valve, seems to be the only form suitable for an equilibrium valve, but this is not practical for engines of rapid motion like the locomotive and small stationary engines. For such engines, the old three-port single valve device (performing its three-fold function of *admission, cut-off* and *exhaust*) will continue to hold its own against all competitors as the ultimatum of simplicity in that line.

But it has been found to be far more economical to use four valves, viz., an inlet and an exhaust, at each end of the cylinder. There are several of these four-valve systems now in use, and, notwithstanding their greater complexity, they have been productive of great economic results, and, I think, their economy might be still further enhanced by carrying out more fully the "multiple port" idea.

For instance, let each inlet port consist of several very narrow openings (*a*)—say, one-fourth of an inch wide, with an inch bar (*b*) between them, and let the exhaust openings (*c*) be half an inch wide; this proportion will admit of but $\frac{3}{4}$ inch maximum range for the inlet valve (A) and $\frac{7}{8}$ inch for the exhaust valve (D), and will allow of $\frac{3}{8}$ inch tap for the inlet and $\frac{1}{4}$ inch tap for the exhaust valves. The number and length of the openings must, of course, be determined by the size of the engine, but their width and the range of valve need never exceed the amount above stated for the largest class of engines. For small engines, these openings may be reduced to $\frac{1}{8}$ inch, and less, with a $\frac{3}{8}$ or $\frac{1}{4}$ inch bar.

It will be noticed that, in all of the four-valve systems, the movement of the exhaust valve takes place under a very light pressure of steam; hence, the chief valve friction is caused by the inlet valves. By carrying out this "many port" idea sufficiently, the travel of the inlets may be so abridged as to reduce the valve friction to a mere fraction of what it is under the old three-port single-valve system. I think that this "gridiron" four-valve idea, if properly carried out, would prove the best possible substitute for an equilibrium slide valve.

The sectional sketch shows the piston (P), cylinder (E), inlet valve (A) open, exhaust valve (D) closed.

An "anti-tramp bolt" has been invented by an Ashtabula, Ohio, genius which allows the door to be opened about six inches, but no further, unless the party inside is pleased with the personal appearance of the one outside. An improvement is about to be added, with a phonograph attachment, so arranged that if the tramp asks for cold victuals the thing will kick him off the door step and into the street and call a policeman.

The question of a system of water-works for domestic and fire purposes, suitable for the present and prospective needs of Joliet, Ill., is being agitated there. A petition is being circulated among tax-payers asking the City Council to adopt the necessary measures for building the works, which, it is estimated, will cost $50,000.—*Engineering News.*

Several new manufactories are contemplated for Kensington, Philadelphia.

Letters from Practical Men.

Editor American Machinist:

A short time ago, while in a machine shop connected with a foundry at which I was having work done, my attention was called to a planer which was in operation, but which was chattering very badly. I thought, at the first glance, that it was owing to the nature of the material operated upon, but the second glance showed another cause. The cutting tool used was about eight inches long, and of ½ in. by 1 in. steel. Instead of sliding the tool into the tool post the greater part of its length, as the operator should have done, he had placed it so that only the extreme back end entered the tool-post. This, however, was not all, but, to make the matter worse, the tool-post was screwed down to its lowest position on the crosshead.

The first thought after noticing the state of affairs was: The machine is in charge of an apprentice; but by watching, I soon saw that the "apprentice" was a man fifty or sixty years of age, and, as I have since learned, has run that identical planer for several years. As I left the shop, the thought came to me: How many of the machinists in the thousand-and-one machine shops throughout the country, are pursuing a similar course? thus giving the various machines operated *no opportunity* to do the work they were designed to do.

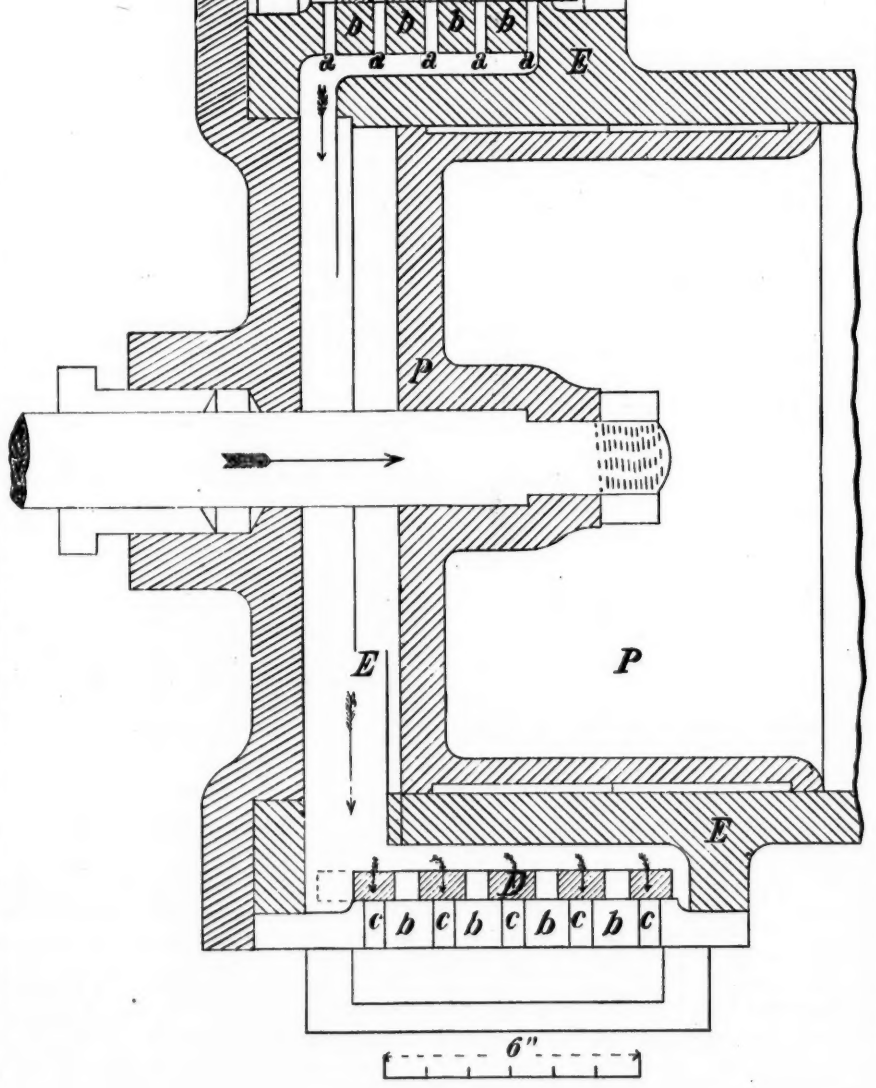
There are often cases in which it is necessary to place the tool in a position similar to that described, as for instance, when a piece is being planed which has projections which would hit the crosshead or tool-post, but such a position should be avoided whenever possible. When such a position is unavoidable, a lighter cut is one of the means of counteracting the tendency to chatter.

I remember, a few months ago, entering into conversation with a young man, working in the same shop as myself, in regard to the position of lathe tools. He remarked that he had "always heard it said that the cutting edge of the tool should be just above the center of the piece being turned."

This, it seems to me, to be but little more definite than the boy's description of the article which was "about as large as a piece of chalk," for it may mean two quite different things. Take, for instance, two round point tools. Let one be forged and ground, so that the front or face of the tool shall make an angle of 80° with the top of the main part of the tool, and the other to make an angle of 55°. It is quite evident that, although the first tool should be adjusted to a point "*just* above the center," the other should be raised *considerably* "above the center." Moreover, observation will show that the practice of machinists varies more than in the examples stated.

In this discussion we have left out entirely the change which takes place in the inclination of the slide rest, when it is adjusted, as in most lathes, by raising or lowering the back end by means of a screw, the front end being pivoted.

When this is taken into account, the two extremes are still farther removed.



The real statement of the case might be put in words something like these: The front, or face of the tool, should make an angle with the tangent, or line of cutting, large enough to give sufficient clearance, and *no more*. The necessary angle is, I believe, usually conceded to about 3°.

A few days ago an accident happened on the circular saw, on which is placed the guard described by Prof. Sweet, a few weeks ago. This accident brings to my mind a remark that I made to Prof. S. at the time it was designed: That a cause of trouble might be, that many persons would suppose that there was no danger in using a saw with such a device attached. As the accident that I mention shows, persons may be injured just as certainly as on a *saw* without this device. The main object of the guard is, to keep sticks, etc., from being caught by the back and top of the saw, and thrown forward against the operator, and, as those familiar with this class of machinery well know, this is the class of accidents most serious in their results.

The guard *will not* prevent the saw from cutting the fingers, etc., if brought into contact with the teeth while in motion. It is not a good plan to "feel of the saw" to see whether it is in motion or not.

There are other methods of determining that matter which are more satisfactory, though, perhaps, none more convincing.

H. L. SALISBURY,

Ithaca, N. Y.

CHICAGO, Ill., Oct. 31, 1879.

Editor American Machinist:

SIR:—I see that the question of "Why American boys don't learn a trade," etc., is agitated considerably now-a-days; and I am sorry to say that nearly all writers on the subject rather depress the afore-mentioned youth than incite him in learning a trade. For instance, "The reason why," in No. 23. Now I am an American, and come from a good family, who move in "good society," and I should like to give the pros and cons of descending (?), as some writers call it, from aristocracy to the machine shop. I have worked in several shops, and I find that machinists, as a rule, are intelligent, industrious, and kind hearted; and if a job is done wrong, the chances are ten to one, that no swearing (at you) will be indulged in. I think "Greaser" has very poor taste in preferring to get up at 7:30 a.m, and working until 9:30 p.m.; to getting up at 6:30 and getting through at 6 p.m. I pity "Greaser," for I know he had an exceptionally hard foreman. I say by all means do what your mind runs to, so long as it is honorable. If a boy has no taste for mechanics, he'd better try something that he has a taste for. But if he has a taste for tinkering, let no letters, talking about roughness in the shop, and foremen not wanting American apprentices, deter him from learning a trade. Then, young man, don't advertise that you want to learn *some* trade. Pick out your trade, or stand by the trade of the man you are asking a job of. Move around the different shops, talking to head men when they are not busy. Don't stay forever in one shop; a short talk will hardly ever be grudged to one who means business, and shows it. And when you get your job, throw your brain and muscle into it. You may not think you are paid enough for such an expenditure, but time will show you that you have made in experience what you did not get in cash. You will find that you rise faster than the other boys. Ask your foreman, and the intelligent mechanics around you, if they know of any good books on your trade to read, and where you can *borrow* them. When you have learned all you can in that shop, and they refuse to pay you as much as the other men, simply because they "taught you all you know," "Bounce them." Some one else will want you, for you will know how to work your cards better. In the new shop you will, perhaps, as I did, find out how little you know. Never mind, the longer you live the more you will find out how little you know.

R. P. BROWN.

P.S.—I don't pity Greaser half as much as I did. I believe he heard all that truck from a brother Wiper.

Economy of Steam Compression.

BY F. F. HEMENWAY.

If, in the multitude of counselors, there is wisdom, we ought to learn something of compression after a time. The different opinions expressed show it to be a good subject to stir up, however, and, through the process of illumination it is undergoing in the MACHINIST, we may, in time, all come to see it alike. It has been tried times enough, and in all its proportions, but, apparently, the coal pile has not been the objective point, since we get plenty of information as to its effect on the motion of the engine, but nothing but theories as to its effect on the motion of coal towards the boiler. I confess to having made use of it from the most homeopathic doses, to the extent of lifting the valves from their seats, and although I can warrant the last-named amount *not* to pay, and have settled for myself what seems to me to be right, the same reasoning that convinces me would fail to satisfy another. While yet

fairly open to conviction, I do object, on general principles, to the manner in which the advocates of a high grade of compression refer to a mysterious saving effected through its agency; as if the mere bunching up a mixture of steam, air and water and then letting it go again was a wonderful, though entirely inexplicable, economical process. To this argument of imprisoning heat to re-heat the cylinder, previous to the next admission, nothing can be said of its effect, because nothing seems to be known. It may be good economy to furnish heat to re-evaporate water, some of which might escape with the exhaust steam, while, on the other hand, it may not be.

In No. 8, current volume, Mr. Church submits two theoretical diagrams, and professes to show, from the one with greater clearance, a saving amounting to from 6 to 7 per cent., by compression, without any reference to the heat-trap theory. Now, I am obtuse enough to believe, if an examination of this diagram shows anything—looked at in the light in which it is presented—it shows an absolute loss from compression, and, unless there is some mysterious gain in this process of saving heat at one end of the stroke to throw it away at the other, it is, in itself, a complete demonstration that it costs more to do the same work with than without compression.

Mr. C. has given us the water consumption with and without compression, *but at widely different mean effective pressures*, and, in doing this, has simply shown the theoretical saving from more expansion, as well as the fact that, for this showing, it don't make any difference at which end of the diagram you employ it.

Why not tell us that, at the same mean effective pressure, the water would figure the same without compression as with it? Mr. C. further says: "Cushion (compression) is only a *spring*, which absorbs momentum from the fly-wheel, it is true, but *returns* it all, with the strictest honesty, as soon as the engine passes the center." If this is true, it is the only example known in mechanics where the useful effect is equal to the cause, and solves the problem of perpetual motion. Undoubtedly, the energy of which the fly-wheel is robbed by compression can be accounted for somewhere, but, unless there is something in the operation which annuls all known laws of friction, we shall find it spread out all the way from the fly-wheel to the piston, and back again, the former receiving back a part only of the energy of which it has been robbed, the rest having been absorbed by the friction of the cross-head and crank-pins, and main journals, and having done duty in wearing out these pins and journals with their brasses, &c. To illustrate this, take one of the diagrams previously referred to and couple it with another like it, thereby making a pair precisely like the one from which Mr. C. figures the saving by compression. By describing a circle to represent the path of a crank-pin, the effect of compression to create friction on that pin, as well as on the main journals, may be profitably studied. It will be seen that a distance, *a*, *b*, has been passed through by the crank-pin, in the formation of each diagram—since, without sensible error, we may suppose the effect of the angular vibrations of the connecting rod to correct itself for the two strokes—after the pressure arising from compression has become equal to the pressure resulting from expansion, and, of course, during this time, the piston possesses no effective energy, except what it possesses by virtue of the inertia of the reciprocating parts of the engine.

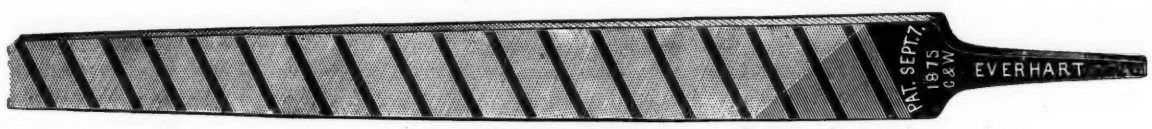
The back pressure resulting from compression, computed from crank pin positions, and above the expansion lines, amounts, when reduced to terms of the whole stroke, to 10 lbs.; and when to this is added more than 9 lbs mean effective pressure lost by compression, and which must be made up by a later cut off, we find the crank-pin, journals, &c., must move under a pressure greater by 19 lbs. per square inch of sectional area of piston, with this amount of compression, than with none at all. I can't say what this would amount to, but it would be a liberal percentage of the total friction of the engine, and would materially assist in keeping the journals hot. Used to just the extent of changing the direction of pressure on crank-pin previous to the stroke in the opposite direction, this frictional loss may be made to disappear almost entirely—certainly be greatly modified. The employment of short-stroke engines has made compression almost—perhaps quite—a necessity, but there is, so far, no evidence that it is not a necessary evil.

Stated briefly, compression, considered by itself, is neither a loss or gain, there being no gain from its employment that would not result from expansion proper; while, on the other hand, there is no loss from the lower grade of expansion, which its use makes imperative, since what would otherwise be lost is saved by exhaust closure. There is, practically, however, a loss from compression, especially when carried to, or nearly to, boiler pressure, from the fact that the crank pin and journals have to revolve under a greater mean pressure, resulting in a loss of useful effect and increased wear of these parts. It has no beneficial effect on the motion of the engine, except when employed in a moderate degree, but, on the contrary, when carried to excess, often defeats this object by causing the engine to "pound" before the center is reached. It, in effect, decreases the capacity of cylinder, making a larger one necessary for the same work, and, by regularly robbing the fly-wheel of energy, makes it necessary to increase the size of that as well. As an offset to these, it possesses the yet-to-be-demonstrated economical property of saving heat in one place and throwing away an equal amount at another place.

The Stow Flexible Shaft turns up in a new role, according to the *Journal of the Franklin Institute*, namely, as furnishing a novel method for cleaning sand from castings. Evidently this ingenious appliance will bear watching, or its next appearance will be as the champion dish washer of the period, and a boon to housewives. The following is the description of its latest adaptation:

After some unsuccessful attempts with ordinary wire brushes, an entirely new principle was adopted, which was found to meet all requirements. The new brush is made in the following way: Two thin iron disks, about four inches in diameter, are mounted on a threaded spindle, one end of which is attached to the flexible shaft. These disks are placed about 2½ inches apart, and are connected by a series of small rods placed at intervals around the circumference. The "hub" thus prepared is not unlike a small squirrel cage in appearance. Upon these rods short wire links are loosely hung, and from the links depend wires of ordinary round steel, about three inches long. We have thus a brush whose bristles are held to the backing by a free joint instead of the usual rigid connection. When stationary the wires hang perfectly limp, but when in motion, at the proper speed, the centrifugal force keeps them normal to the axis until the surface to be cleaned is reached, when they yield and drag across it. It is found in practice that the brush so constructed is as efficient as the stiff brush, and is much more pliable, adapting itself better to irregularities in the surface, while the wear is entirely confined to the joints and gradual abrasion of the ends of the wires.

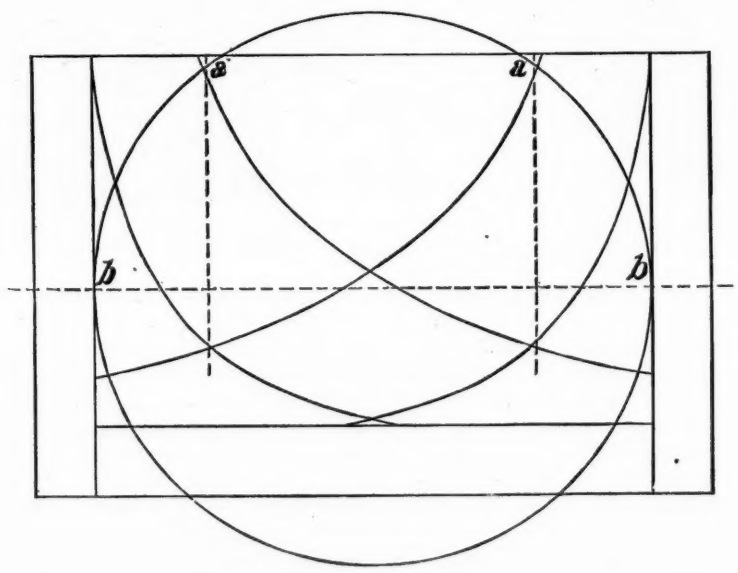
All the stove foundries are in full operation. The strike, which was maintained for several months, has entirely ceased, and the moulders are glad to get back to work at the former prices.—*St. Louis Jour. of Commerce*



A PATENT CUT FILE.

A Patent Cut File.

We present on this page a view of a peculiarly cut file, which, although used to some extent for four or five years past, will be new to most of our readers. It is constructed on the principle of a tap or die, grasping a clean new hold at every space or depression instead of binding or slipping, as is often the case in the ordinary cut. It takes all the chips in the depression, thus keeping the file clean and free from clogging, and it is claimed will cut much faster than the ordinary file. When well worn it still holds close to the work. The makers claim that it not only saves a percentage in file bills but also in wages. Its peculiar claims are rapidity of cutting, durability, and smoothness of finish. These files are being supplied to consumers by Morgan & Herrick, 86 John Street, New York.



Has the Steam Engine Indicator Accomplished what is Claimed for it?

BY STEPHEN ROPER.

Ever since the days of Watt, who is claimed to be the inventor of the steam engine indicator, (whether he was, or not), its recordings have been surrounded with a certain amount of mystery, simply because a knowledge of its functions and uses has been confined to a few. It is only natural that those who claim to understand it should throw as much mystery as possible around it. We know, it is claimed, that the indicator has aided materially in perfecting the steam engine, and perhaps this is the case, so far as proportioning the steam ports and valve gear are concerned, but what it has done to promote the graceful proportions and improvements, both in durability and convenience, that may be witnessed in the other parts of steam engines, its advocates do not inform us. The indicator does not take into account the defects or improvements in bed plates, housings, cranks, crank-shafts, or other adjuncts of the engine, nor does it make any difference, so far as the diagram is concerned, whether their proportions are designed scientifically, whether they are uncouth imitations or not, providing they possess sufficient strength. It is a very noticeable fact, that those who declaim so loudly on the aid which the indicator has rendered in perfecting the steam engine, scarcely ever allude to what good machinist's tools, good workmen, and material have done for the steam engine in point of durability and efficiency. I do not think it is is claimed by the most sanguine advocate of the indicator, that that instrument has rendered much aid in the improvement of the rifle, the revolver, the sewing machine, the drill press, the lathe, the planer, or taps and dies. Nevertheless, their improvement has been equally as wonderful, and their design and proportions as magnificent as the steam engine. Even the steam pump, in point of design and proportion, has kept pace with the steam engine, while in point of efficiency it is not one whit behind it. This naturally gives rise to the inquiry, Would not the steam engine be just as perfect as it is if the indicator had never been invented? A short time ago the writer had an opportunity of examining a 25-horse-power engine, that was built in one of the New England States, 35 years ago, and, although the two young mechanics, who designed and built it, might have heard of the steam engine indicator, it is certain that they never saw one, and would not have the knowledge how to use it if they did. Nevertheless, on examination the proportions were found to correspond with those of the best improved engines of the present day, while the finish was tasteful, and the fitting excellent, considering the character of the machinist's tools at that time.

Many of the oldest manufacturers of the best description of automatic cut-off and throttling engines in the country take very little stock in the indicator. They scarcely ever apply it to their engines, and when they do, it is more, as a matter of curiosity, to see how the engine is working than for anything else, while others are continually portraying the wonderful things that the indicator is capable of doing, although they very rarely show the wonders it has accomplished, in a practical point of view. Experienced manufacturers, steam users, and purchasers of steam engines, place more faith in the quantity of work that an engine can perform, with the consumption of a certain quantity of fuel, than they do in any tracings, that may be transmitted to slips of paper by an indicator, attached to a steam engine, because they believe that estimates of steam engine economy, based on the indicator diagram, are frequently delusive and erroneous, if not always so, at least to a certain extent. The foregoing remarks were suggested, first, because the writer is impressed with the idea that there is a good deal of delusion and uncertainty about the indicator business; and second, because he wished to afford an opportunity, to the advocates and champions of the indicator, to demonstrate its useful effect.

There have been strikes from all manner of ridiculous causes. One that occurred in Central America recently, as narrated by a correspondent of the New York *Tribune*, seems funny, but it is not more so than many that are occurring frequently in this country. It seems that this arose from the introduction of a watch to regulate the hours of labor. The men had adopted the theory that a certain donkey employed on the work brayed accurately at four o'clock (the quitting time) each afternoon. So long as the time-piece and the donkey agreed approximately, no difficulty was encountered; but one day the watch was half an hour slow, or the jackass brayed half an hour ahead of time, and the men nearly revolted in a body because the watch was decided by the foreman to be the more reliable time-piece.—*Iron Age.*

Hotchkiss' Mechanical Boiler Cleaner.

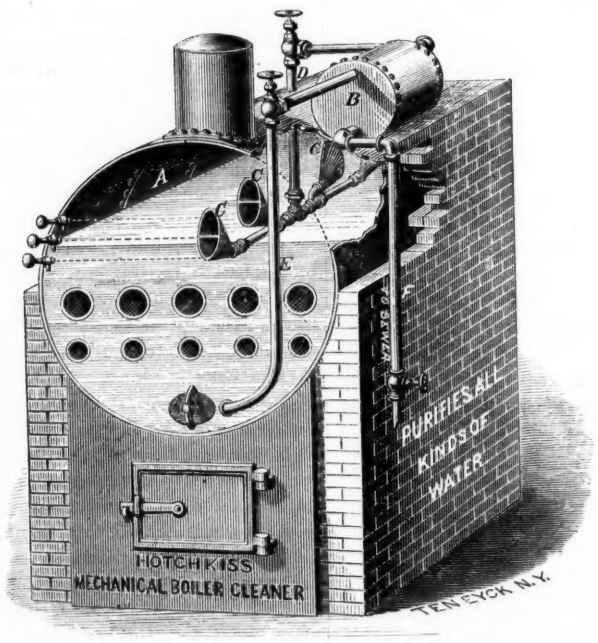
The two engravings on this page represent Hotchkiss' Mechanical Boiler Cleaner attached to a boiler and ready for operation. The cast iron bells C C are connected with a horizontal pipe laid on, or so near the flues as to bring the bottom of the bells on a line with the lower gauge cock. This pipe connects with a vertical pipe D passing through the upper shell of the boiler to an improved reservoir, B situated in a convenient location on top of the boiler (or by its side above the water level). The pipe E, returning the water purified to the bottom of the boiler.

The method of its operation as explained by the proprietor is that with the heating of the water in the boiler the vacuum in pipe D and reservoir B is filled with a solid stream of water which being removed from the direct action of heat, is dense in character, and the hotter water from the boiler is constantly rising and displacing (by syphon action,) the denser water in the reservoir, which flows back to the boiler. The circulation thus produced being from the surface of the boiler water, (to which point all sediment is carried as soon as separated by heat, being held upon the surface by ebullition,) the sediment is carried by circulation to the reservoir, where being no longer sustained by the agitation of the water, it gravitates to the bottom of the reservoir, to be blown off through pipe E leading to the sewer or other convenient place.

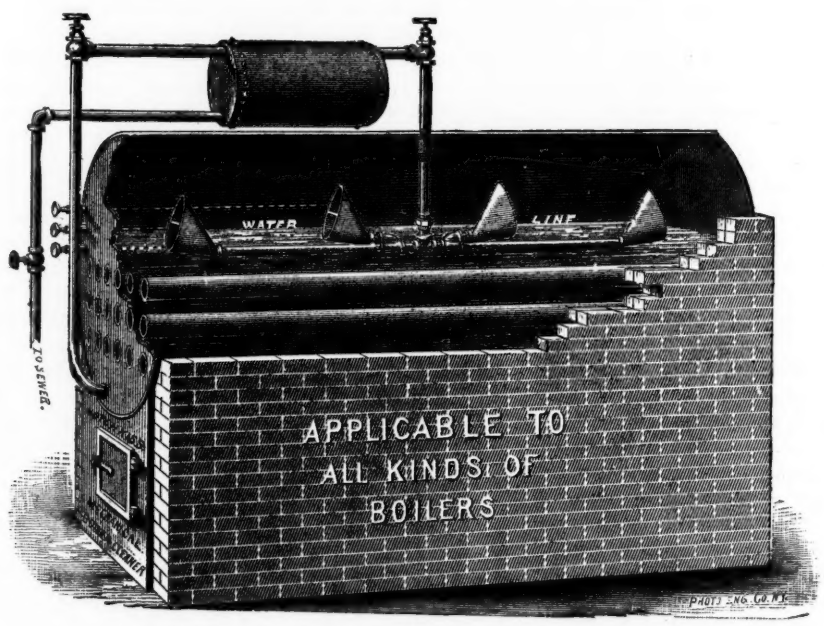
This apparatus has been thoroughly tried, with almost every kind of water, and has worked to the entire satisfaction of all parties concerned. It is in use by some hundreds of steam users in the United States and Canada.

The use of scaling salts and liquids in steam boilers may work very well in certain localities, but it is utterly impossible to produce a scaling compound that will work well in every kind of water, no matter what the manufacturers may claim. The placing of any substance in boilers to prevent or remove scale necessarily causes some extra trouble and expense. The engineer will soon get tired of seasoning the feed water with any sauce or mixture, and neglect it altogether. Besides, every patented mixture for cleaning boilers involves a constant expense. The mechanical cleaner, herewith shown, requires no attention from the engineer, and therefore does not add to his duties. The mud, lime, and impurities rise to the surface in the boiler and are carried through the funnels (skimmed off) into the reservoir B, where they are deposited on the bottom and can be blown out at any time by a turn of the blow-cock. A working model was exhibited in our office by the proprietor, James F. Hotchkiss, 84 John St., N.Y. The reservoir B, being of glass, exhibited the ingress of the impurities very clearly and their precipitation.

The demand for iron is now so brisk that a burglar who wants a "jimmy" must leave his order a whole week in advance.



End View of Boiler with Cleaner.



Side View of Boiler with Cleaner.

The Hand-Planer.

BY J. L., IN "ENGLISH MECHANIC."

Of all the workshop appliances recently brought within scope of those of limited income, none, perhaps, for general utility beats the hand-planer. It is essentially an amateur's machine, suited for work of small dimensions. America, as usual, originated it, and if it were not for one defect, it would be invaluable, but I have found the feed action frequently miss fire, and the tool then travels again over its former path, and makes the work unsightly, besides detracting from its excellence. Of course any particular machine may prove defective, but these, I fancy, are made to gauge, and therefore I may conclude that the tool is somewhat defective generally in this particular. I am not sure, however, that the new machines have not been altered at that part, as I have lately seen an engraving of one identical in all other respects with my own, but different in the feed action.

If screw-chasing is the Pons Asinorum of amateur turners, filing is the same to amateur machinists; and files, especially when unskillfully used, wear out rapidly, and cost a lot of money. But even setting aside the question of cost, it is not an easy matter to level by hand a surface even a couple of inches square, and such necessity occurs so often that any satisfactory mode of doing the work by mechanical appliances like the planer is well worth consideration.

The American planer is an independent machine, not fitted to the lathe, which is of itself an advantage. It has a good solid base, which only needs to be bolted to some stout bench, and takes up but little room. A few precautions and a little practice are needed to make success certain, but no more than in the manipulation of any other workshop appliances.

The planer cuts in midway between the lathe and the file, shaping work even of circular form when some projecting part prohibits it from being turned, and saving a vast deal of labor, and a good many files in reducing flat surfaces to the required dimensions; but for finished work the planer is always supplemented by the file, or by that tool and the scraper, which last is now universally used in getting up level surfaces to the highest attainable degree of perfection. There are, nevertheless, a great many cases in which no further finish is needed than that which the planer will produce, even with a pointed tool; and the equidistant parallel lines left on the work are not unsightly, but quite the contrary, and merely take the place of draw filing. In ordinary planing machines the work is securely held down upon a flat bed which is itself truly and accurately level; so that if one side of the work has been planed and this is laid upon the bed of the machine, the second surface will be planed parallel to it without special adjustment. There is, however, supplied with such machines (and with shaping machines) a planing vice, to hold objects which cannot be readily held by the usual screws and clamps. The American hand-planer has no such bed, but only a parallel vise to hold work of all kinds, so that it is necessary to get up parallel surfaces in a different manner.

The vise chaps are 1½ in. above the surface of the frame on which they slide, the upper part of which is planed, and is slightly above the leading screw which draws one of the jaws to and fro. This frame is exactly like that of a slide rest, and as its surface is planed and sufficiently broad, it takes the place of the planer bed when the work is thick enough to lie upon it (*i. e.*, 2 inches thick and upward), the vise jaws securely grasping it. The latter are made with steel faces with a true upper edge, and are hardened. The only guides for truth of position of the work, therefore, at command are the face of the frame and the upper edge of the vise jaws, and both are sufficiently accurate to serve for adjusting all ordinary work. To show the best way of proceeding, a bar of square iron may be taken of the full length to which the jaw will open, viz., 4 inches, and one inch broad on each face. This, we will suppose, needs to be squared up. As it will be cut from a rolled bar or forged nearly to size, the ends may be first squared roughly with the file so as to give the vise jaws a fair grip; the ends will be finished subsequently.

First, see that the planer is in order, the slides nicely adjusted to work without shake, the feed gear oiled, and the pinion adjusted to allow a sufficient stroke with as much freedom to the arm as possible. To give the full stroke of four inches, the lever handle will have to sweep round from the back till it touches the tool holder in first, giving a considerable amount of rather tiring exercise to the muscles. The proper position of the machine is with the vice on the left, the rack and pinion on the further side, the handle, at each stroke, passing over the slide; I have, however, sometimes reversed it, using the left arm for the lever, to relieve the other. I clamp the machine, sometimes, to one end of a 6 ft. lathe bed; but at all events, it should have a firm stand of some kind. A vise bench clamped to the wall will answer, with a couple of bolt holes cut in it for the holding down screws.

Next look to the angular adjustments of the several parts. The tool box is at the end of a stout round bar of iron, which passes through two sockets in the upper, or tool slide. The front socket is sawn through to form a clamping ring, a screw causing it to grasp firmly the bar of the tool-holder. On the face of this front clamp are a number of divisions, and on the bar is a line as an index. These divisions may easily be overlooked, but are of great value in adjusting the tool-holder and tool for angular work. The 45° and 90° are marked both to right and left of the central line. A similar set of graduations are made on the face of the bar upon which the vice swivels, so that the work and tool are equally capable of all necessary adjustments. For the present purpose we have only to see that both are in a vertical position by the coincidence of the index lines.

We now grasp the work in the vise somewhat loosely and allow the tool to traverse it, but without actually touching, by which we are enabled to see that the ends of the bar are as nearly as possible at the same height, and also that the bar is parallel to the path of the tool, so that the cuts will traverse it from end to end; for, though not essential, it is better that this should be the case, as the work will look neater than if the lines upon its surface were diagonal. Having, as nearly as may be, adjusted the iron in these two particulars, it must be secured by a turn of the vise screw, but care must be taken not to bend it by undue pressure. There is not much danger with a piece of the size named, but with others of less dimensions it is but too easy to damage it if held in this way. The tools for planing are in shape and form of edge precisely the same as those for metal turning. I have an excellent set made for a slide-rest, by Blakey, of Halifax, which happen to fit the American planer, and I invariably use them. A small cutter bar and cutters may also be made and used advantageously. With a diamond-pointed tool well sharpened and a light feed, take a cut from end to end, and you will at once see whether you go too deep, or whether any other fault exists. The motion should be smooth and even, a clean decided cut, not a mere scratch, and if you work on wrought iron, lubrication with soap and water or soda and water, will assist in cutting, but cast iron and brass are worked dry.

The long leading screw has a winch handle at one end to enable the tool-box and its slide to be shifted into position; but when this is done and the tool placed where it is required, the screw must be clamped as it must not be allowed to revolve. There is a thumb-screw below it for this purpose. The feed then takes place by the motion of a circular nut, cut into notches to receive one end of the reversible pawl, which drives it round a few notches at a time, a pin on the side of the tool slide giving it the requisite motion at each stroke. I have found this pawl miss its notch now and then, causing the tool to traverse the same cut twice, which shows disagreeably on the work when finished. If the feed acts well, and the tool cuts nicely, the finished work will be marked with a series of fine parallel lines. If the first cut is not enough to remove all inequalities a second must be taken, and even a third or fourth will often be required. To reverse the feed all that is necessary is to turn over the pawl and allow its opposite hook to come into action, and a little downward motion being given to the tool-slide, about one-sixth of a revolution of the screw, all is ready to repeat the cut.

When one side is satisfactorily faced up, one of those adjacent to it is next to be attended to, and in placing the bar in its new

position great care is needed. Set the bar as before, but with the new face to be worked uppermost, leaving the vise only just screwed up enough to hold it slightly. You have to adjust it not only level from end to end, but so that this upper side when cut shall be truly square to the first. Place the back of a small steel set square upon the level surface of the vise-frame on the near side of the vise-screw—having placed on the side the surface already planed, and gently tap the bar until this surface accurately touches the blade of the square (a square with a broad back to stand alone is the best to use). This will insure planing the second face square to the first, and is the only way with a planer of this kind. To secure the level position of the bar the test of the tool point made to traverse just clear of it, is I think the best, unless you have a scribing block which will stand upon the vise-frame, like the square; but with all possible care at this stage you cannot insure a perfect level; but if it is desired to be really accurate in this respect, correction has to be made when the other surfaces are planed, because the unplaned surface may have a part much raised, comparatively speaking, above the general level, and such raised part *may* occur at either end. When, however, you have planed the two adjacent surfaces, as well as you can, you will have a guide to work by in placing the bar to plane the other faces. (Absolute truth would be attained with the file and scraper after finishing with the planer, and a surface plate as well as scribing block would be required, but at present I am confining my remarks solely to the American hand-planer.) The second face having been treated like the first, the next adjustment of the piece must be made with one of the finished faces underneath, and the other in front, next to the workman. Using the square against the latter as before, you are now able to secure also the level position of the upper face, by gauging the height of its opposite lower one already finished. If each end of this lower face is adjusted to the same height above the bed or frame of the vise, the surface to be now worked will be planed parallel to it. For this measurement a pair of calipers, or compasses, can be used, or a scribing block, or a simple wedge-shaped flat gauge of tin or card to be inserted at each end, successively to a mark made on its surface, or any other equally simple appliance can be substituted. The third face will then be planed, and, subsequently, with exactly the same precautions, the fourth side, and the whole will be finished, if due care was taken, to a considerable degree of accuracy. For the final cut on either side, the tool should always be taken out and re-sharpened to produce good results, and a pointed tool is better than a rounded or flat-edged one. The ends of the bar can, after the above work is complete, be marked all round with a scribing point, ruling the lines by a square in the same way as wood is marked for cutting off or mortising, and thus marked a file carefully used will finish the bars. A still better way is to turn the extreme ends in the lathe, but filing will suffice very well.

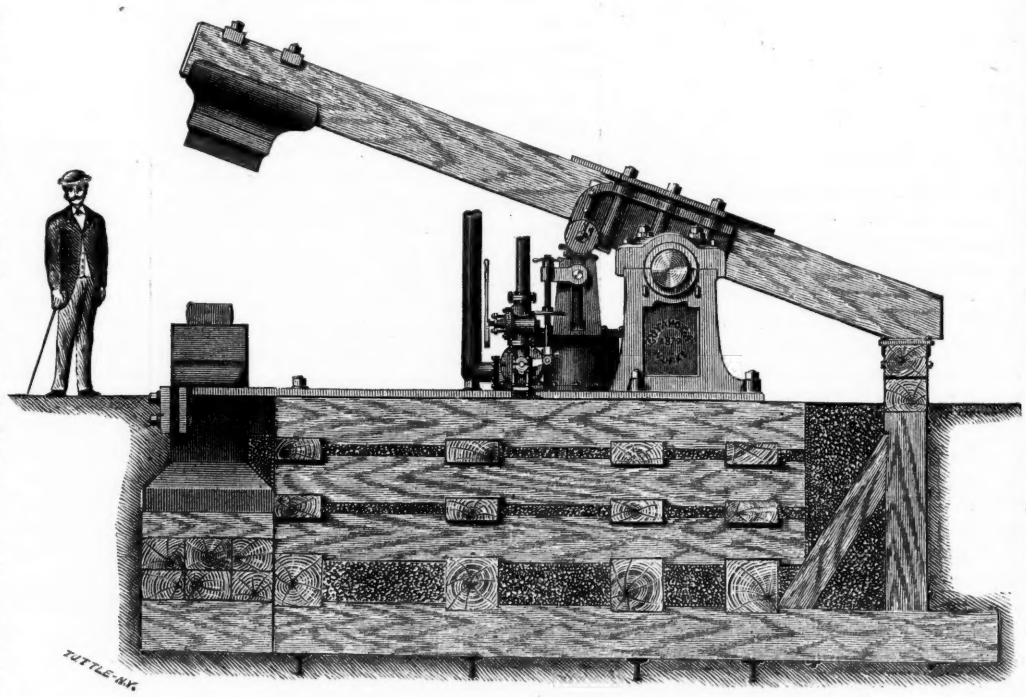
It is stated that a stock company composed of New York and Philadelphia gentlemen, representing a cash capital of $250,000, have purchased the water power facilities at Willow Grove, N. J., and will immediately build factories there, with the anticipation in view that at no distant day the new railroad will be extended from Newfield to Elmer.

Three hundred moulders employed in the stove foundries, Quincy, Ill., are on strike. They demand an increase of 10 per cent. in their wages. The strike was ordered by the Moulders' Union.

Improved Steam Hammer.

The very natty-looking gentleman shown in the accompanying illustration, after a thorough inspection of the workings of the improved steam hammer represented by it, has evidently reached the conclusion that the West is able to produce some things outside of hog and hominy after all. The workmen who ordinarily run the hammer were probably just around the corner when the view was taken (it being noon hour), munching their midday meal, and, at the same time, conning over the pages of the AMERICAN MACHINIST, or meditating upon the advancing standards of shop practice contained therein.

This hammer embodies the experience of its makers, the Cuyahoga Works, Cleveland, Ohio, in the construction and successful operation of a large number of steam helve hammers for the use of steel works, forges and rolling mills in the West, and deserves the careful attention of similar establishments in other sections, as well as abroad. One of the important improvements claimed for it over the usual style of helve hammers is the kind of steam valve and valve motion used, and its location on the steam cylinder. The valve used is known as the semi-rotating slide valve, having a patented steam balance on its back, which, while very simple, is effective in relieving the valve from a large share of the steam pressure upon its face, and, consequently, relieves the valve gear from friction and wear.



HOLLOWAY'S STEAM HAMMER.

The steam balance valve is located on the side of the steam cylinder towards the anvil block, and is at or near the bottom of the steam cylinder; thus making the steam port short and direct, so that at each stroke of the piston the condensed steam is drained from the steam cylinder. The kind of valve, as here arranged, permits the use of a long, narrow steam port, which gives the hammer a quick, sharp action; while the unusually large and direct exhaust port allows the steam from under the piston to discharge so freely, that the blow of the hammer head is claimed to be much greater than in any other hammer of the same size and weight. There are numerous other details of construction, which cannot well be explained without reference to drawings or to the hammers themselves.

Great care has been taken to so proportion the various parts of the machine, that no undue strain will come by reason of shrinkage of the castings; and the metal used, both in the forgings and castings, is all of the best quality.

These hammers are built of the following sizes, furnished with hammer head and one pair of dies, and with or without anvil block, as desired:

1,800 pound Hammer; with steam cylinder 24 inches bore, suitable for car axles and shafting up to 5 inches diameter.

2,000 pound Hammer, with steam cylinder 26 inches bore; suitable for large car axles and shafts up to 12 inches diameter.

3,000 pound Hammer, with steam cylinder 30 inches bore; suitable for making shafts 18 inches diameter.

4,000 pound Hammer, with steam cylinder 32 inches bore; which will make shafts or shape work of any size usually wanted.

The rapid action of these hammers also makes them very efficient for fagoting or making blooms.

Gleanings from the Foreign Press.

MILD STEEL AND STEEL SCRAPS FOR SHIPS AND MACHINERY.—Messrs. Napier & Sons, the famous shipbuilders of Glasgow, have just launched a new steamer, the Pizarro, of 3400 tons displacement. She was built entirely of open hearth mild steel, manufactured by the Steel Company of Scotland. The owners have saved 200 tons of hull weight, and can, therefore, carry 200 tons more of paying cargo. The steel was tested carefully before being used, and not a single plate or angle was found defective. For all the smaller smithwork about the engines of the Pizarro (levers, rods, weight-shafts, etc.), scrap steel was worked up and forged in the usual way, no difficulty being met with in welding and working.

A REVOLUTION IN STEAM POWER.

The *Universal Engineer*, Oct. 10, has an article on a new invention of M. Testud de Beauregard, of Paris, which is creating much excitement in that metropolis. It is a new method of utilizing and transferring steam power, that is claimed to revolutionize mechanical industry. The inventor has some strong claims to recognition, being an eminent engineer who has given the closest attention for thirty years to the study of heat energy and steam generation.

The very best of our engines—even when condensing, and of large size—scarcely develop one-sixth of the theoretical value of the fuel they consume. Smaller engines, non-condensing, do not develop one twelfth, and the average class of commercial engine, up to ten or twelve-horse power, do not develop one-twentieth.

This shows there is plenty of room for improvement.

The causes of this enormous wastefulness are not very far to seek. The first great loss occurs in the furnace of the boiler, in which only from 50 per cent. to 75 per cent. of the available heat is absorbed by the water. This may be roughly estimated in the following manner: The average temperature of a boiler furnace may be estimated at 2,000 deg. Fahr., and it is well known that the temperature of the escaping flues or chimney of any boiler is usually not far from 500 deg. Fahr. This shows a waste of 25 per cent., but it is often higher.

The next great cause of waste is the fact that we use a material such as water, which changes its form to develop power of elasticity, and, during that change, absorbs an enormous amount of so-called latent heat. In the case of steam, this heat of conversion, or latent heat, amounts to 966.6 deg. Fahr., or, roughly, five and a half times as much heat as is required to bring an equal weight of water up to the boiling point from a freezing temperature. It is, therefore, easily perceived that the largest part of the heat really absorbed from the furnace is required to change the water into vapor, this heat thus becoming latent in the steam.

Now, after we have utilized the elastic force of the steam in an engine, what use do we make of the latent heat to produce work? None at all. The nearest attempt we make to utilize the latent heat is in a negative manner—by condensation and the production of a vacuum. But the resulting product, even in that case, is an enormous amount of hot water—say 125 gallons per nominal horse-power per hour, at a temperature of 110° Fahr.—which is thrown away as useless. This weight of condensed water amounts generally to about twenty times the weight of water evaporated; we thus have for comparison of effect one pound of water raised from 60° to 212° Fahr., and then converted into steam by an absorption of 966.6°, which gives a total of 152°+966.6°=1,118.6° Fahr. units communicated by the fire to the water in the boiler, and in the same time 20 lbs. of water at 110° thrown away, which represents 110−60=50×20=1,000° Fahr. units thrown away, thus leaving only a balance about of one-tenth of the whole heat communicated to the water as having been absorbed as work. And if an allowance of from 25 to 60 per cent. loss be now made, as having taken place in the boiler, it is easy to see why we do not realize more than from one-tenth to one-twentieth of the theoretical value of the fuel burnt.

M. Testud de Beauregard has gone to the source and foundation of this serious loss, by proposing no longer to use the steam as a direct medium of power, but to use the water itself in the motor, only making the steam serve the purpose of an elastic cushion to drive the water forward.

This stream of water M. Beauregard proposes continuously to return to the boiler in a never-ceasing circulation, and thus, of course, he would escape the above-indicated serious loss of allowing the exhaust-steam or hot water to escape.

He intends to use an arrangement of closed boiler from which the water is taken under a very high pressure, generated by an elastic cushion of steam, to work a water-motor: the water to be returned to the boiler by a system similar to that of the injector.

Evidently there was a screw loose in the management of the St. Louis Fair just closed. Prompt publicity is the best cure for such tendencies. We quote from the St. Louis *Journal of Commerce:*

One year ago, a leading house in this city put into Mechanical Hall a fine display of their goods at the opening of the Exposition—awards to be made during the last, or Fair week. At the opening of Fair week a rival house was allowed to put in a display, after having had a chance to see the displays of others, and having had three weeks to prepare their display, and, as might have been expected, they took the premium. Said the president of the former firm: "We would not go out there now if they paid us for it." In this connection we may repeat what a leading manufacturer and dealer said a week since: "If they had offered a prize for a display in our line instead of spending so much in premiums for boy soldiers, I should have made a display that would have been worthy of a St. Louis Exposition."

The *Boston Commercial Bulletin* congratulates the country over the production of umbrella silk that will endure the strain of American weather, and goes on to say that the difficulty of obtaining a silk umbrella which would not speedily split in the folds, and resolve itself into sticks and rags, has been generally accepted as one of the indications of deterioration in foreign silks.

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Workmen and Apprentices.

An undoubted proof of the marked advance of liberal ideas, during the last few years, is the growing readiness of skilled workmen generally in all branches of the machinery trades, not only to permit the introduction, but to favor the systematic training of apprentices in shops, where such a policy of strong opposition as has largely attended the workings of trade-unionism elsewhere, must of necessity carry great weight from the strength and intelligence of those employed.

But it is this very intelligence, which is every day more and more clearly making plain to the leaders and shapers of industrial thought, and through them to the greater number around them, who are also learning more and more to be thinking men, that the repressive policy can no more be permanently successful and advantageous in workshops, than in any other department of modern activity. It is as plain to these men, as to others, that such a policy can have no other result than to fill the shops all about them with incompetents, whose methods of workmanship and ways of living, not less than their total lack of intelligent ambition, must inevitably tend to degrade the standard of wages, as well as the social status of all connected with them.

No competition is so difficult to meet, as competition with the untaught, the unthrifty and the unthinking, because there are many employers even, who, if not exactly unable to detect inferior work, are yet more or less willing to gloss it over, and pass it by, so long as daily experience shows it to be low-priced and salable. It is only when a more enlightened judgment, upon the part of the purchaser, compels more ingenious methods, more accurate workmanship and finer finish in the goods which he buys or uses, that such a manufacturer fully appreciates the value of the skilled workman, who is not only able to do work rapidly, but to do it neatly, economically and well. Then he ceases to measure all men's services by the low standard of either machine scratching or machine feeding, and the real workman finds his true place and his just reward. Sooner or later, good work in one shop compels as good or better work in competing shops. But it may be safely premised that just so long as the great body of workmen in any branch are untaught, incompetent and ill-paid, just so long must the few who are neither remain, in a measure, under a cloud. In this, as in most things, the liberal policy is the best. The merchant who opens a store next door to, or in the same street with, powerful competitors in the same line of trade, the manufacturer who prefers to settle in a town or neighborhood largely devoted to his special branch, the lawyer who hangs his shingle in the very inns of court, all recognize, by their example, the practical value of this principle.

Why, then, should not the masters of mechanism recognize it and profit by it?

Let every man, therefore, who finds his own ingenuity stimulated by contact and competition with shrewd, thinking minds about him, reflect how much pleasanter, in every aspect of life, such competition is, than competition with so-called workmen, who feel themselves munificently paid if they receive bare living wages. Let such throw the full weight of their influence in favor of every agency and every system whose aim is to ennoble their business, and to train and stimulate the new men who must of necessity come into it. And the more heartily, if, as in a great multitude of cases, the workers whose powers are to be trained, are their own sons, or the sons of comrades and shopmates.

But does some one say that the present methods of apprenticeship only fill the ranks of workers without materially improving the average of skill? All the more reason why skilled workmen should make it their business to advance the standards of apprentice training. But how shall this be accomplished? By counseling the young and enlightening their parents and friends regarding the practical shortcomings of the systems now being hesitatingly tried in many shops, by organizing opinion in the shops, by manifesting genuine pride in the advancement of shop methods and shop standards, and by many other means which the good sense of skilled men everywhere will enable them to invent and apply. And in so doing, they will not only have the manly satisfaction which comes from helping others, but the more substantial recompense due to those who help themselves.

About Ourselves.

With its next issue, the AMERICAN MACHINIST begins its third year of publication. Originally started monthly, in November, 1877, as an out-and-out independent practical mechanical journal, without the adjunct of a patent right agency, a book store, or a machinery agency, and, without advocating any special hobby or scheme, it at once gained the confidence and support of representative establishments and progressive artisans in the several branches of machinery and steam engineering. Adhering firmly to the principles laid down at the outset, and refusing to surrender any portion of its reading columns to paid notices, it has retained and steadily extended that most gratifying confidence and support. In taking a retrospective view, we can, without exaggeration, refer to the success of the AMERICAN MACHINIST as being heretofore unequaled in the first two years of the existence of any mechanical journal in this country. Although, during that period, several scientific and mechanical periodicals have suspended or "consolidated," by reason of limited patronage, we found it necessary to change from monthly to weekly to satisfy the demands of our readers. Sustained by a liberal patronage, we have given careful attention to improvements, and shall continue to do so, sparing neither pains nor expense to maintain and enlarge the position already achieved. Articles are appearing in our columns from the acknowledged best mechanical writers of the day, no other journal presenting the *original* utterances of such an array of master spirits of mechanical progress. Other leading names will be added to this concourse of practical thinkers and writers, and the value of every issue increased.

We shall continue our second volume until the end of the year 1879, and publish an index at that time. The third volume will begin with January 1, 1880, and, thereafter, every 52 numbers will constitute a volume.

The American Institute Display.

New Yorkers are fond of grand exhibitions, and are disposed to patronize them liberally. If the show is a moral and instructive one it draws a class of visitors that rarely, if ever, patronize the theaters, circuses, or muscular contests of men and beasts. Oftentimes the grandeur of an exhibition stands out more prominently in the anticipation, excited by skillful advertising, than in the realization; but when this is the case, the average citizen swallows his disappointment in silence and turns his attention elsewhere. In some respects the American Institute Fair, now at its height, is a grand exhibition, and in some other respects it is just the reverse. The large rink, filled with a variety of productions, the music, and the concourse of visitors make up the grand part; the active side-shows, presided over by glib-tongued venders of patent hair restoratives, preparations of seidlitz powders (of which all passers-by are urged to swallow a sample), tooth brushes, perfumery, confectionery, toys, and various nostrums and gimcracks make up the opposite part. The only "processes of manufacture" (as mentioned in circulars sent out before the opening) that we could find in the machinery section were the process of squeezing out sweet cider (selling at 5 cents a glass), and the process of cutting out wooden toys on several band saw machines, and disposing of these at 5 cents to 25 cents each.

As a Hibernian visitor remarked, "all the empty spaces are now full." Most of the machinery exhibits have been here from two to six times before. This, however, does not detract from their value to a purchaser; but so long as there are plenty of suitable applications for space, articles that have often been displayed should be crowded into close limits, or out altogether, to leave room for new and late improved pieces. Such a course should be taken if the exhibition is conducted to aid industrial progress, rather than for the emolument of its managers and their friends.

Another improvement is needed in the interest of mechanical advancement. The regular admission price should be reduced from 50 cents to 25 cents. Many working mechanics are deterred from visiting the fair, either alone or accompanied by their families, by reason of the excessive fee demanded at the entrance. If the display is to be a Fair, in the real sense of the word, and not a bazar, the above improvements challenge attention.

It takes but little power to drive all the running machinery, and the two fine horizontal engines on exhibition have no opportunity to show their working powers. A thorough expert trial of the Buckeye engine and Lowe boiler will take place in a week or so.

The Otto gas engine is shown in operation. It consists mainly of a jacketed cylinder with piston, slide valve, and governor, working a cut-off mechanism to regulate the supply of gas according to the varying load on the engine. The cylinder and piston perform alternately the functions of a pump and of a motor; first pumping in the combustible charge of gas and air (one volume of gas being used to 15 volumes of air) and compressing the same, then upon ignition of the charge by a gas jet and the slide part arrangement, taking an effective or working stroke, and on its return expelling the exhaust. The combustible part of the charge serves upon ignition to expand the remainder, thereby avoiding shock and effecting a large economy. The engine has also the peculiarity of igniting its charge at the beginning of the stroke, leaving the whole of the stroke for effective expansion of the gases, instead of a mere fraction, as in other methods of combustion. These engines are well adapted to intermittent service for small power (2 to 7 H. P.), and do not interfere with ordinary fire insurance.

A peculiar willow-splitting and planing machine is shown by Jos. Popping, New York. In appearance it resembles a feed-cutter for cattle. It splits a willow into either 2, 3, or 4 withes at once, and the planer smoothes each withe neatly and rapidly. It runs by either hand or steam power, and is claimed to do as much in a day as the best man can do in a week unaided by special machinery, besides saving largely in material.

Newell & Chapin, West 19th street, New York, exhibit half-a-dozen styles and sizes of their Universal Grinding Machines. There are two shafts, upon which are mounted grinding disks of chilled iron, with beveled edges, angular indentures, and upon the circumference of the disk radial cutters or teeth. These disks engage with each other, upon opposite shafts, and revolve inwardly. In operation the mill grinds instead of crushes grain, and almost any substance that can conveniently be reduced by such a process.

W. T. Horrobin, of Cohoes, shows a new grate bar that has no side pieces, also allows for linear expansion and contraction. It is a wide bar and is so constructed as not to warp even with severe usage. They do not necessitate the admission of air back of the bridge wall, but allow a sufficient quantity to pass through the coal. They are also easily cleaned.

Mr. Wm. H. Hoffman treats our readers, this week, with his second article on Boiler Proportion and Construction. Users of steam boilers, and especially those expecting to purchase boilers, should read and preserve his articles on this subject. Mr. Hoffman has prepared some working drawings of an engine, which we will publish soon.

LITERARY NOTES.

A NEW TREATISE ON ELEMENTS OF MECHANICS, ESTABLISHING STRICT PRECISION IN THE MEANING OF DYNAMICAL TERMS, ACCOMPANIED WITH AN APPENDIX ON DUODENAL ARITHMETIC AND METROLOGY. By John W. Nystrom, C. E. 8vo. Cloth. Price, $4.00. Published for the author by Porter & Coates, 822 Chestnut St,, Philadelphia.

The author of the above work has been well known, for a number of years, as a close student of mechanics and its connecting links in the chain of science, and his indomitable labor has been repeatedly crowned with success. The pocket book on mechanics, by the same author, which was noticed in a late issue of the AMERICAN MACHINIST, may be mentioned as one of these, having become a standard work of reference on the subject. The object aimed at, in the present work, has been to introduce a treatise which should carry with it sufficiently strong evidence for the establishment of strict precision in the meaning of dynamical terms, and the classification of physical quantities into elements and functions.

The need of a work of this kind has long been felt, which would embody a revised edition of the principles of mechanics and the true meaning of technical terms, and the constitution of dynamical quantities. This has been fully proved and acknowledged by learned men, who have heretofore disagreed on the subjects named. Most of the students in mechanics know, to their disgust, the confused state of this subject, and the many true and false theories which have been advanced during the past fifteen years, and it was almost impossible to find, even in the best scientific periodicals, a sound article on dynamics; but the action and combination of physical elements are treated as if governed by individual judgment instead of the fixed and immutable laws of nature. There are many points which are essentially new, and are alone sufficient to warrant the publication of this work.

The appendix is added for the purpose of supplying the student with materials for the coming revision, and final establishment of an international system of metrology, which will certainly require attention sooner or later. The technical terms adopted in this work are those used in the machine shop, rejecting those in the vocabulary heretofore used only in the text books and colleges. The terms and definitions used are concise and will be readily understood. There is a list of rejected terms by the use of which ideas have been imperfectly understood, and which have different or indefinite meanings; these have been wholly abolished in this work. It is the only work that we have ever seen which establishes strict precision as to the true meaning of dynamical terms, and classifies the physical quantities into elements and functions so as to render the subject of mechanics a positive science, simple both to teach and learn. This new system of mechanics has been thoroughly discussed by learned men both in America and Europe, and although at first received with some doubts or opposition, has at length been generally accepted as not only right, but also the only system based upon sound principles.

The most crucial test of perfection of any science, is, precision in its vocabulary and perspicuity in its principles, so that expression bears only one definite meaning. In a statement of Wm. Dennison, Esq., not long since, he says: "I consider the basis upon which you (the author) have placed this subject to be firm and well constructed, and of such a nature as never to be overthrown or destroyed. Had there been such a treatise in our school days, it would have been of great assistance to us all, then and since." The duodenal system of arithmetic contained in the appendix is worthy of careful consideration, and presents new and novel ideas which are both interesting and useful. The book, as a whole, is well printed in clear type, pleasant to read, and treats exhaustively on the subjects under consideration.

WENTWORTH'S ELEMENTS OF PLANE AND SOLID GEOMETRY. By George A. Wentworth, Professor of Mathematics in Phillips Exeter Academy. 12mo. Half morocco. 400 pages. Price, $1.45. Published by Gunn & Heath, Boston, Chicago, and 20 Bond St., New York.

So many books have been written upon geometry, and so much thought has been bestowed, both upon the subject matter and the style in which it is presented, that it seems almost impossible to make a book which will have marked characteristics and yet be valuable. But Prof. Wentworth has secured this result in a remarkable degree. The appearance of the book, when one opens it, is good and lasting. The figures are neat, the type clean and the arrangement good. A study of the plan shows further excellences. In no case is a leaf turned in order to complete a demonstration; the order of proof is logical; no unnecessary words are used; every independent statement begins a new line; symbols are freely, though not too exclusively, used; the references are separated from the text, and the substance of the reference is given parenthetically. These things are of great advantage to the student, but cannot take the place of the essentials of the subject. But when combined, as they are in this book, with correct definitions, correct statements of propositions, and logical processes in the demonstrations, it makes a book of great value. It contains a large number of well selected exercises, which serve to illustrate and enforce the principles of the subject.

ICE-MAKING MACHINES: The Theory of the Action of the Various Forms of Cold-Producing, or So-called Ice Machines. Translated from the French. Price, 50c. D. Van Nostrand, 23 Murray St., New York.

This is No. 46 of Van Nostrand's Science Series. It is useful to all those interested in the manufacture or operation of ice-making machines. The explanation of the theory is aided by engravings.

Business Specials.

Forty cents a line for each insertion under this head.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Steel Stamping Letters, Figures, and Dies, 1-16 to ⅛ Figures, per set, $3.00; ⅜ Figures, $1.00. American Tool Co. Cleveland, O.

Tool Chests with best tools, scroll saws, wood and designs. Amateurs' and Machinists' Tools. Send for Catalogue. Tallman & McFadden, Philadelphia.

LYMAN'S Universal Screw Cutting Index and Rule for Compound Gearing. Price, 10 cents. Address E. Lyman, C. E., New Haven, Ct.

FOR SALE.—Two patent centering and squaring attachments for lathes; center and square up at one operation. Made by R. E. State & Co. Entirely new; price, $20 each. Lock Box 291, Springfield, Ohio.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) J. L., Philadelphia, Pa., writes: Please inform me which is the best way to calculate the Horse Power of steam boilers? If you have already published an answer to this question, state the number, as I am purchasing all the back numbers of the AMERICAN MACHINIST, so that I may have them on hand for reference. *A.*—The requirements for one Horse Power were given in answer to question 4 in our issue of July 5th, 1879, and in addition to it we would say that there is no recognized standard rule for the H. P. of boilers, either in this country or in England, but there are general rules which are used for boilers intended for economical work, viz.: for plain cylinder boilers allow 15 feet of heating surface, and 1 square foot of grate surface; for flue boilers 15 feet of heating surface and ¾ square foot of grate surface, and for tubular boilers, well proportioned, 15 to 16 square feet of heating surface and ½ of a square foot of grate surface for each H. P.; a little more grate surface will give better results in some cases. The above is the proportions for boilers and grate surface, but in regard to the amount of heating surface allowed per H. P. we would say from 12 to 12½ feet as a safe rule to follow. It is not a good plan to go to extremes in allowing an excess of heating surface, for in it there is no economy, as is erroneously represented by some manufacturers. A 15 H. P. boiler is too large for a 10 H. P. engine; in other words, it will not work with the same economy as a properly proportioned boiler.

(2) E. H., New York, writes: Will you please inform me, through your valuable paper, the most improved method of case-hardening iron screws in large quantities? *A.*—The best way, where a large amount of case-hardening is required, is to have a furnace built on purpose for the work, constructed on the reverberatory principle in order to insure a steady heat. Put the articles to be hardened (before finishing) into an iron box with animal charcoal, composed of burnt hoofs, horns, bones, leather, or skins, pulverized, care being taken to cover each article completely. The materials placed in the box consist usually of 90 per cent. of carbon, and the rest either carbonate of potash or of lime. The lid of the box should fit, and be sealed with a lute of equal parts of clay and sand, then placed in the furnace and heated up to a bright red, and kept at that temperature until such a time as the articles will acquire the required depth of case-hardening, which will vary from half an hour to two hours and longer, when they are to be removed and dropped into water. The secret in case-hardening successfully is generally in keeping up the heat sufficiently high that the process of carbonizing may go on uninterrupted until finished. The boxes should not be too large as the heat will not penetrate as uniformly as in the case of a smaller box. It will require some practice before the operation can be successfully accomplished. A blower should be attached to the furnace.

(3) E. L. S., Middleboro, Mass., writes: Please answer the following questions: 1st.—Which is the best way to prepare hemp packing for piston rods? *A.*—The hemp should be prepared in long, loosely-twisted coils, well saturated with melted grease or tallow with as much pure graphite (black lead) as it will absorb. The packing should be inserted when the engine is cold. 2d.—What parts of brass, copper, and tin will make a metal that will polish nicely? *A.*—Speculum metal is susceptible of a very high polish, and is composed of the following proportions, viz.: copper, 2 parts; tin, 1 part. 3d.—Who are the proper authorities to grant a license to run a stationary engine? *A.*—Please name the locality where you desire to run, as a license is not required in some places. In New York we have a Metropolitan Board of Examination and Inspection, who grant licenses, etc.

(4) J. N., Collingwood, Canada, writes: Will you please give me a rule for finding the velocity at which water rushes into a condenser where only a partial vacuum is formed? Say through a four-inch pipe, with the open end of the injection pipe four feet above the water in the lake, the vacuum gauge pointing to 26. By giving a rule to suit all cases you will greatly oblige. *A.*—We cannot give you a rule which will suit all cases, but if you will refer to the latest edition of "Haswell's Engineers' and Mechanics' Pocket Book," in the part relating to hydraulics, you will find all the instruction you may require on the subject. In reference to the opening in the pipe being four feet above the water in the lake, we would say that it would amount to a fraction over 2 pounds, and would not be noticed on your vacuum; in other words, it would not affect materially the flow of water to the condenser.

MANUFACTURES

Dunbar, Hobart & Whidden contemplate making a 50 or 60 foot addition to their factory at South Abington, Mass.

The Bodwell Granite Company, of Wayne, Me., are making a forty-five foot addition to their works, the new portion to be used for a machine shop.

The Herreshoff Manufacturing Company, of Bristol, R. I., are laying the foundation for a wooden building, 65 by 40 feet, to be used as a finishing shop.

The Belcher & Taylor Agricultural Tool Company of Chicopee Falls, Mass., have hired in fifteen new hands, and are still behind their orders. B. & J. W. Belcher have also increased their force.

Aultman & Co., Canton, O., turn out an annual product of more than $2,000,000. Of their thresher they made 1,200 the present season, and increased the manufacture of their Buckeye mower more than sixteen per cent., besides turning out three times as many binders as they did last season.

The Jessup & Moore Paper Company has purchased a large lot in the western part of Wilmington, Del., on which to erect extensive works for the making of paper pulp from wood. The expenditure for this operation is estimated at nearly $250,000. These works, when completed, will give permanent and fairly lucrative employment to a large number of operatives.

The Diebold Safe and Lock Company, of Canton, O., last week shipped to a bank in St. Paul, Minn., a large safe which they consider as nearly burglar proof as one can be made. Its outer walls, of solid metal, are about two inches thick, made as follows:—One slab of the Chrome Steel Company's three-ply metal, one of Park Bro. & Co.'s five-ply, one of Anderson & Co.'s five-ply, and a fourth of Park Bro. & Co.'s three-ply. The corners are solid, the metal being specially angled for the purpose, so that the burglar has no advantage from a corner seam or joint to start with. It is believed that two skilled mechanics, provided with the best tools, would not be able to drill into a safe thus constructed in twenty-four hours. The method of making the metal for safe walls may be briefly described thus: If for five-ply, two pieces of iron are set in the ingot mould at the proper distances apart, and the spaces between filled with melted steel. The ingot is then rolled into slabs, and is ready for the safe maker's use. When two-ply is to be made, the same process is followed, except that only one piece of iron is set into the mould.

The Connellsville (Pa.), *Courier* says: Our manufacturing industries, with the exception of the locomotive works, are in full blast, and most of them running night turn part of the time. The Connellsville Machine and Car Company, and Tennant, Boyle & Co. have more work than they can do, and are daily receiving new orders. The Baltimore & Ohio Railroad Company are constantly increasing the number of men in their shops, owing to their greatly increased freight traffic. Our contractors and house builders, blacksmiths, wagon makers, and in fact all our mechanics seem to be full of business.

The moulders of the Crawford Manufacturing Company, Allegheny, have resumed work, the ten per cent. advance for which they struck having been conceded.

The car works at Swissvale, Penn., have lately changed hands, and, it is said, will be occupied by an Eastern firm as a manufacturing establishment.

Baugh's Steam Forge Company, Detroit, Mich., are building an addition to their works, Totton & Co., of the Fulton foundry, this city, having a contract to supply new machinery therefor.

The Lynchburg Mining and Manufacturing Company is the title of a new organization, which will reopen the long idle rolling mill at Lynchburg, Va., build a new blast furnace and go extensively into the manufacture of steel rails. John F. Hartranft, ex-Governor of Pennsylvania, is one of the corporators. Extensive mines in the vicinity have also been secured by the company.

The Florence Tack Co., Florence, Mass., will shortly enlarge its buildings to enable it to keep up with its orders.

The Lowell, Mass., Machine Shop has now in employ one thousand mechanics engaged in making cotton machinery, and they have very large orders ahead.

A Worcester woolen manufacturer is said to be seeking for a location at Holyoke. Mass.

The Akron, O., steam forge was started lately, and is now running all its hammers on full time.

Parties from Youngstown, O., have been looking over the old Wheatland, Pa., iron works, with a view to leasing or purchasing them. The citizens of Wheatland are much elated over the prospect of the early starting of the works.

The Billings & Spencer Company, Hartford, Conn., are working 70 hands 13 hours per day, and have orders for about six months to come. The orders for sewing machine shuttlework never were so good as now.

The Zanesville, O., plow manufactory is being enlarged by the addition of a three-story building, 33x100 feet.

The Phoenixville, Pa., Iron Works, says an exchange, are short of hands and find it difficult to get additional help.

Wm. E. Uptegrove (New York City) purchased the property known as the 10th street saw mill, on the 6th of September. It consists of eight lots of ground running through from 10th to 11th streets. Mr. Uptegrove contemplates making many improvements, now that he is the owner of the property. The mill is already supplied with five veneer saws and two hand saws, besides planing machines.

Martin Worn, Brooklyn, E. D., is making an addition to his large furniture factory.

Hay & Co., Winslow, N. J., (Glass manufacturers), have signalized the return of better times, by advancing the wages of their window glass blowers ten per cent. upon those paid last year. They are crowded with work.

The new machine shops of Gen. J. T. Wilder, at Chattanooga, Tenn., are expected to be completed by December 1st.

The display of machinery at the St. Louis Exposition has been very meager, and indeed very far from satisfactory. Few manufacturers have participated in the exhibition.

The Evansville Iron and Steel Company, of Evansville, Ind., has filed articles with the Secretary of State. The company propose to operate an iron and steel rail mill at Evansville. The capital stock is $300,000, divided into 6,000 shares of $50 each. The directors for the first year are Arthur B. Meeker, Wm. K. Brown, Horatio Pratt, E. H. C. Richardson and Wm. G. Stephens.

The moulders at Crawford's Malleable Iron Works, Allegheny, have struck for an advance of ten per cent, and the adoption of a sliding scale.

Messrs. C. B. Grubb, of Lancaster city, and E. Haldeman & Co., of Marietta, Pa., have raised the wages of employees in their mines from seventy to eighty cents per day. Outside parties think there is room for a few more cents advance.

The Russell Manufacturing Co., of Middletown, Conn., are preparing for the erection of an addition to their factory in that place, 40x90 feet, three stories high.

W. P. Townsend & Co., wire and rivet manufacturers, New Brighton, Pa,, are erecting a large addition to their works.

The new glass works at Wellsburg, W. Va., will be a frame building, 70 feet square and 16 feet story, and another building 60x120 feet, with two stories, 9 and 12 feet respectively. There will be ten pots. The works will be ready for operation by the 1st of next January.

There are sixteen new buildings started in Caribou, Me., including a large steam grist mill, a block of four stores and a large saw mill.

The Eclipse Steam Pump Works, Pittsburg, are being increased by the addition of new machinery.

The town of Prescott, Arizona Territory, has adopted the Holly system of water-works with modifications.

The Vergennes Machine Company, of Vergennes, Vt., was sold out at public auction on the 29th of September, under execution for debts. The purchaser of the machinery, etc., is J. D. Kingsland, of Burlington, Vt.

Work is decidedly brisk in the Saco, Me., water-power machine shop at the present time. Near four hundred men are employed, sixty-eight of whom are in the foundry.

Mr. James H. Wilson, for many years connected with the old Lowell Machine Shop, has been appointed superintendent of the Franklin Foundry and Machine Company of Providence, R.I., and has entered upon his duties. The Franklin employs from 500 to 600 men.—*Boston Journal of Commerce.*

A large wooden rolling mill is to be erected by the Norway Iron Works Company at South Boston, for the production of sheet iron, such as is used in the manufacture of locks, cooking utensils and other articles. This will give work to between forty and fifty more men.

The employees in the shops of the Allegheny Valley Railroad at Hulton, Pa., have asked for an advance of ten per cent. in their wages.

The miners in the Mahoning Valley, Ohio, have had their pay increased from seventy cents a ton to eighty cents.

The Andover Iron Company, Phillipsburg, N. J., on the first of October raised the wages of their miners at Mine Hill and Hibernia to $1.25 per day.

The various industrial establishments in Camden, N. J., are employing additional help. Some of the manufacturers are running their factories day and night.

The Cleveland Paper Company, Cleveland, Ohio, has laid the foundation for a large new paper mill at Eight Mile Lock, south of Cleveland.

It is reported that the wages of the employes in the Elmira rolling mills are to be advanced five per cent.

The new steel works on Clinton Street, Chicago, are nearing completion and will be ready for occupancy in about a month.

The secretary of the State has issued a license for the organization of the South Chicago Steel Works ; capital, $10,000.

Titusville, Pa., is to have a new rolling mill.

Chicago parties are reported negotiating for the Brady's Bend, Pa., furnaces and lands, with the intention of erecting several blast furnaces and a large rolling mill.

There was a strike at the mill of A. M. Byers & Co., Pittsburgh, among the bar mill, ore mill, galvanized iron shops and pipe mill for an increase of ten per cent. in wages. The hands lost several days' work, and then went in at the old wages.

W. C. Allison & Co. are building an extensive addition to their car shops at their works in West Philadelphia.

Mr. Metcalf, of Tamworth, N. H., is to build a spool factory at Conway Corner, 100 ×30 feet.

A new rolling mill at Brier Hill, near Youngstown, O., is projected.

Samuel R. Seyfert is building a new boiler plate rolling mill at Gibraltar, in Bucks Co., Pa., to be finished by March 1.

The Rhode Island Locomotive Works are to build five Forney tank engines with 15×20 inch cylinders for the Evansville, Washington and Worthington road in Indiana.

The Whitney S. M. Manufacturing Company are about to remove their Sewing Machine Works from Paterson, where they have been located in the Dale mill, to Erie, Penn.

Mr. Henry Adams, of the extensive mosquito netting mills, Paterson, employs 900 hands, and believing that kindness is better than force, has on several occasions increased his workmen's pay without solicitation, and on Friday night gave them a grand ball and supper, admitting none but employees, and paying all expenses himself.—*Salem (N. J.) National Standard.*

H. B. Smith & Co.'s foundry, Westfield, Mass., is being enlarged.

The Niles Tool Works, Hamilton, Ohio, have an order from Nottingham, England, for one of their large boring and turning machines.

The Westinghouse Air Brake Co., Pittsburgh, are making a large addition to their establishment. They employ 140 persons, and are working over time.

Machinists' and Engineers' Supplies.

NEW YORK, October 23d, 1879.

Business good and prices either firm or advancing, is the report all along the line.

Crude rubber, which we noted last week as having advanced, has, since our last week's report been making almost daily advances, and it would seem must of necessity affect the prices of rubber belting, packing, and hose. The next meeting of the manufacturers takes place the first Wednesday in November, when action may be looked for.

Sand crucibles (all imported), although now ruling very low, according to the importers' way of thinking, it is thought will soon go lower, owing, probably, to the state of the market among the manufacturers abroad.

J. Berge & Son, 45 John street, N. Y., report black lead crucibles as holding very stiff in price, one manufacturer remaining outside of the combination, although there is no present prospect of an advance.

It is reported that sledges, hammers, wrenches, and all drop forgings, both steel and iron, are soon to take another advance.

Drill presses, milling machines, planers, and machine tools generally, have begun to feel the upward movement. This applies to second-hand as well as new tools.

Copper rivets and burs have advanced to 30% discount during the past week, as predicted in our last report.

Manufactured copper has advanced 2 cents per pound in the last three days: Braziers' being now quoted at 30c. per pound, and Sheathing 28c., basis.

Sheet brass is still quoted at 10% discount, as in our last report, but will probably soon go to net list.

Braziers' solder remains steady at 25 cents.

The Ansonia Brass & Copper Co., 19 Cliff St., N. Y., are introducing a new style of finish in copper, called Patent Nickel Plated Copper, for which special advantages for certain kinds of work are claimed.

The makers of wood screws have advanced the price of flat head iron screws to discount 55 per cent.

Nicholson File Co., Providence, R. I. announce an advance in the prices of Nicholson files to 25% discount.

Iron Review.

NEW YORK, Oct. 23d, 1879.

The demand continues good out of store and from the mills at ruling quotations. There is no sign of weakness, and no indication of the supply catching up with the demand. What changes have taken effect since our last review are in the direction of higher prices on Sheets, Angles, Tees, and Boiler Plates. The tendency is still upward on everything in the iron and steel line.

Pierson & Co., 24 Broadway, New York, quote prices, out of store, as follows:

No. IX Pig Iron, $31 per ton; Iron Rails, $46 to $55, according to weight; Old Rails, $31.50 to $32; Fish Plates, 3c. per lb.; Railway Spikes, 3½c.; Bolts and Nuts, 4½c.; Common Bar Iron, 3c., basis from store; Refined, 3 2-10c., basis; Ulster, 3 8-10c., basis; Machinery Steel, 7c.; Best Tool Steel, 12½c.; Norway Bar Iron, 5½c.; Norway Shapes, 6c.; Nail Rods, 6 to 6½c.; Sheet Iron, 4½c., basis; Angle Iron, 4c., Tee Iron, 4½c.; Band Iron, 3 6-10; Hoop Iron, 3 8-10c.; Horse Shoe Iron, 3 8-10c.; Tank Iron, 4½c.; C No. 1 Boiler Plate, 4¾c.; C. H. No. 1 ditto, 5c.; Best Flange ditto, 6c.; Boiler Rivets, 5c. to 6¼c.; Hot Polished Shafting in lengths, 2 ft. and longer, 7 to 8c., according to size; Small Black Rivets, 50% off in papers, 35% off in bulk.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of Oct. 23d, 1879:

The *Metal Market*, during the past week, has been more quiet—a thing to be expected after the intense activity of the two previous weeks. While business in wholesale lots is not so heavy, the jobbing trade continues fair and prices steady. The stocks of Pig Tin on the spot are unusually light, notwithstanding the arrival of 250 tons within the week. The delay in the arrivals of this article and the light shipments for October indicate that all the Tin yet to come this year will be needed. The London market is steady at £95 to £96 per ton. Singapore is $29½ per picul. We quote Banca Tin, 27c.; Malacca and Straits, 25c. @ 25½c.; Australian, scarce, 24½c. @ 25c.; Engli h Refined, 24½c.; Lamb & Flag, 23½c.; Bar or Strip Tin, 24½c.; Pig Lead, 5½c.; Hallett's Antimony, 19c.; Cookson, 20c.; Western Spelter, 6¼c.; Foreign, 6¾c.; Ingot Copper, 21¾c.@22c.; Nickel, $1.50; Bismuth, $2.50; Solder, No. 1, 13c.; Half-and-half, 15c. During the week Straits Tin to arrive—September shipments—has been sold in round lots at 24½c.

Situations Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

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In *Gray Iron* and *Brass*, for small Agricultural Implements, Churns, Washing Machines, etc., either Plain, Galvanized, Bronzed or Japanned. Patterns and Models made to order. Send for estimates for Castings, etc.
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Also, agents for Shepard's Screw Cutting Lathes
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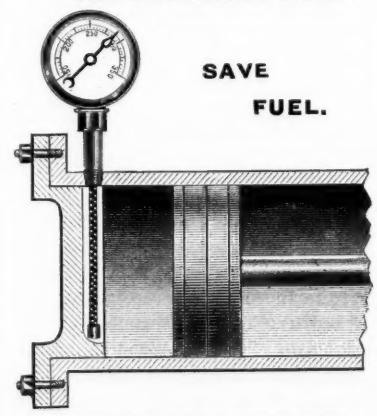
The DIXWELL IMPROVEMENTS
FOR WORKING ENGINES WITH SUPERHEATED STEAM.


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On exhibition at the American Institute Fair with the Buckeye Engine. Estimates furnished on application. Address, during the Fair, 206 West 53d Street, New York.

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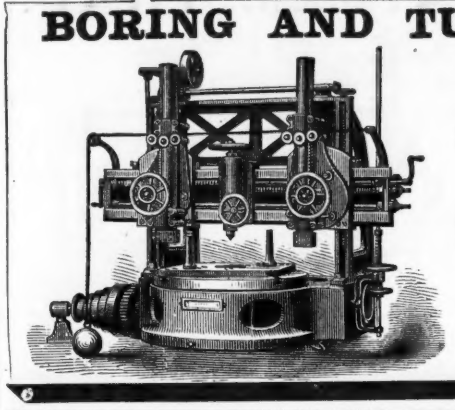

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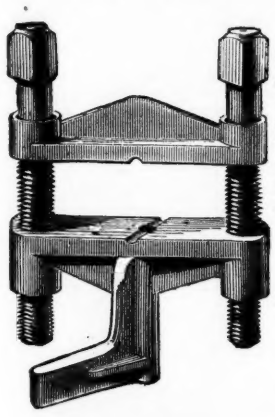

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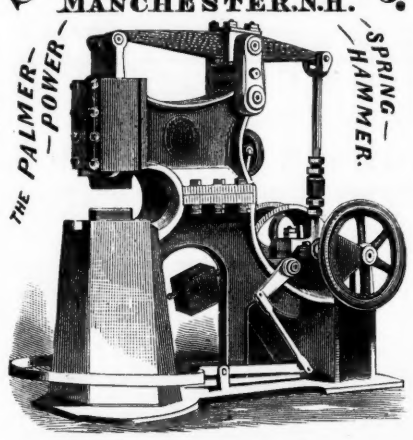

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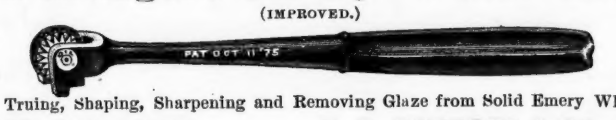

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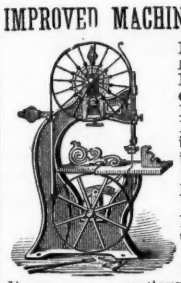

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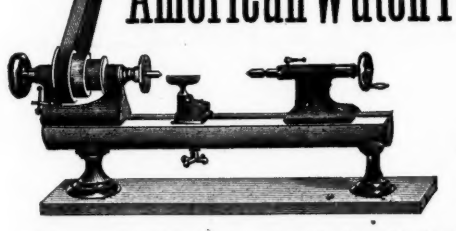

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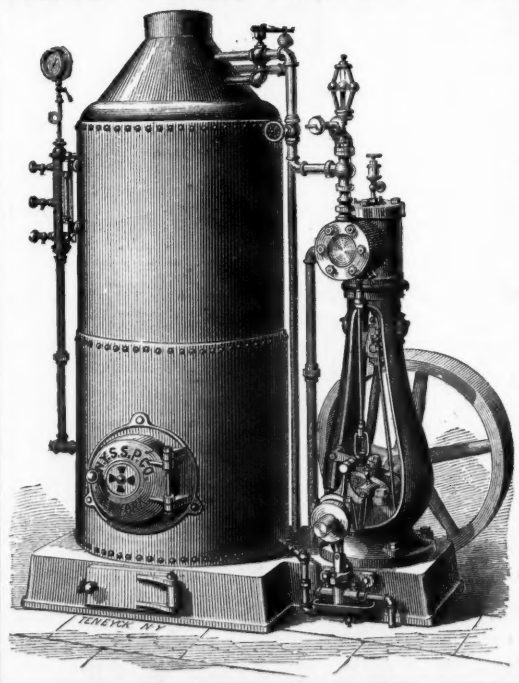

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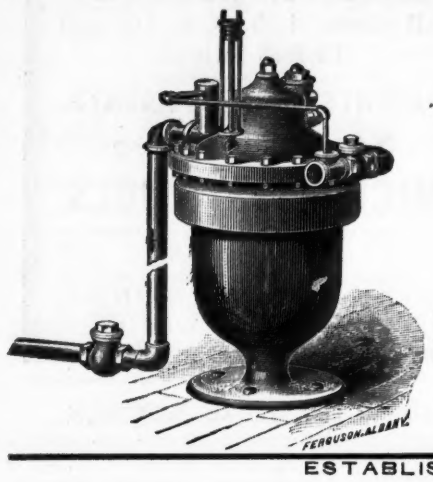

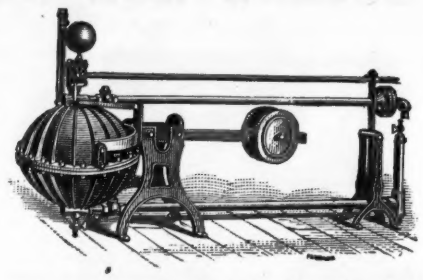

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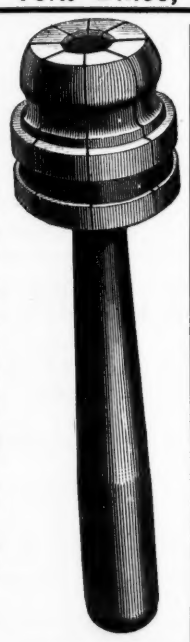

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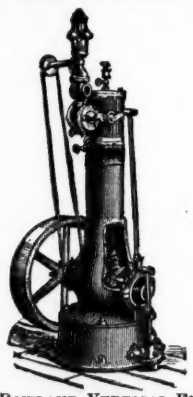

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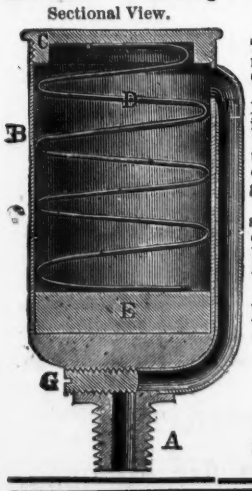

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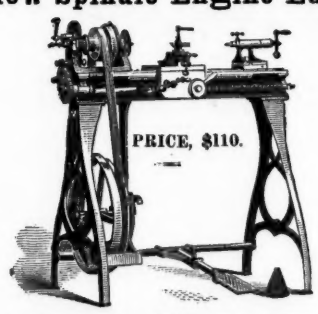

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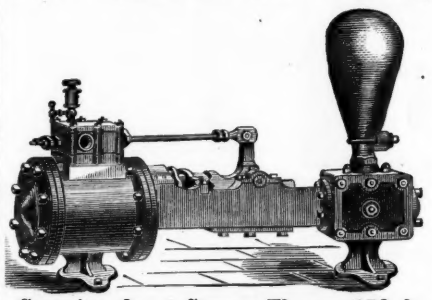

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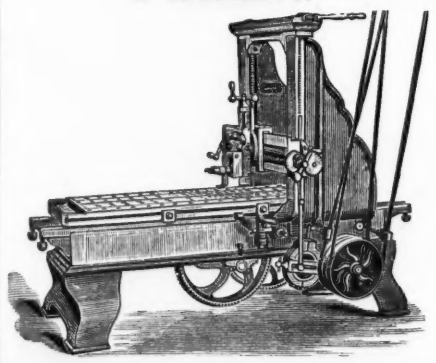

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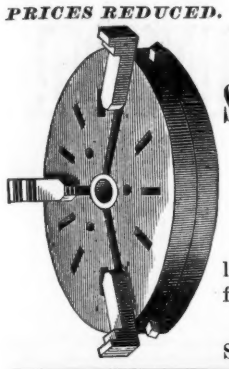

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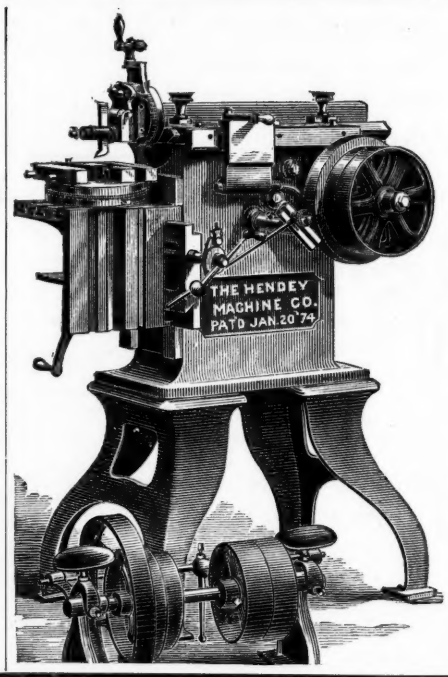

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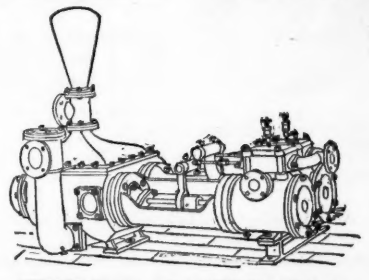

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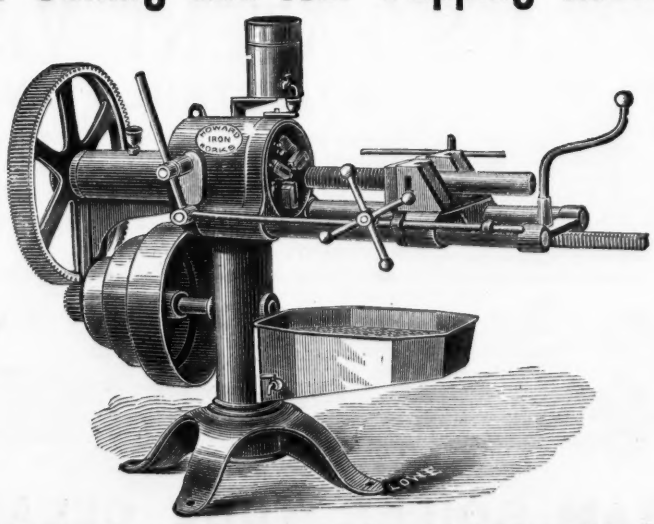

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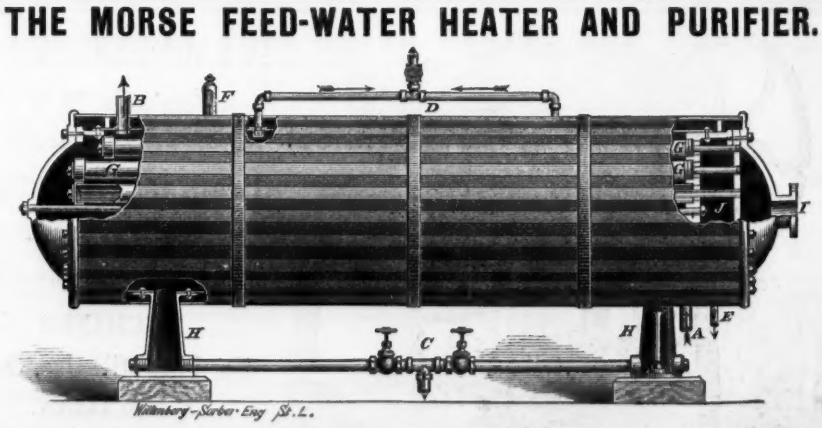

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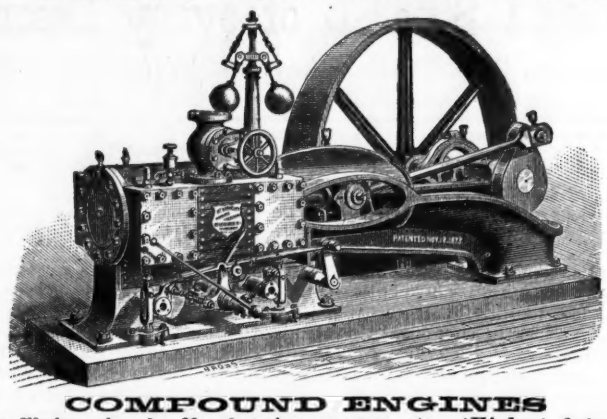

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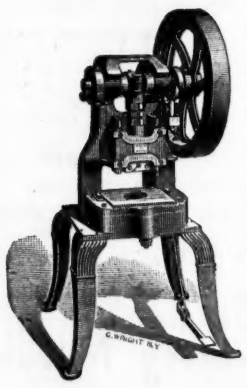

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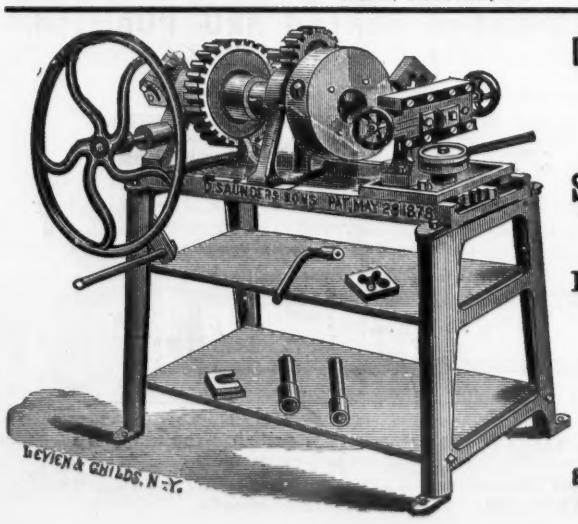

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[We desire to call particular attention to the above letter, as since it was received by us, Lieut. Mahan has confirmed his good opinion of our Engines therein expressed, by ordering two more of them.]

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Cleaned Easily and with little Labor.

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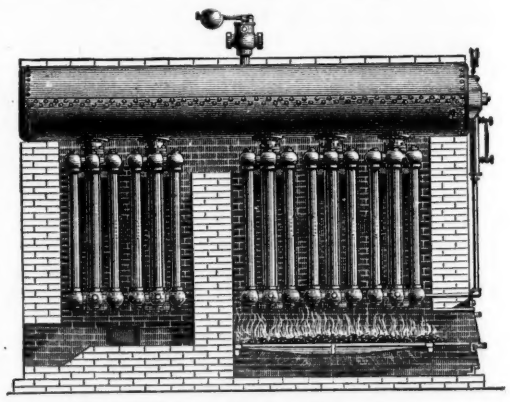

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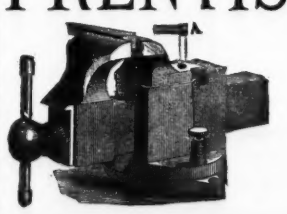

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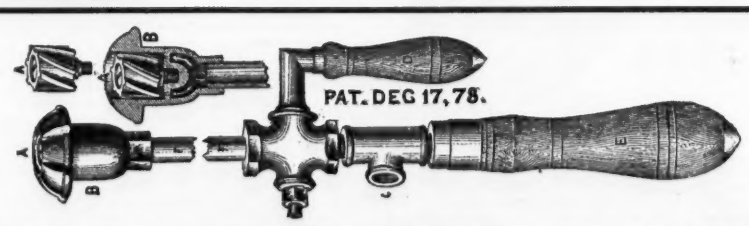

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For illustrated article on Steam Tube Cleaner, see issue September 13th.

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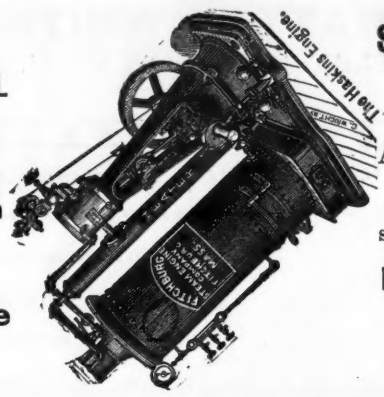

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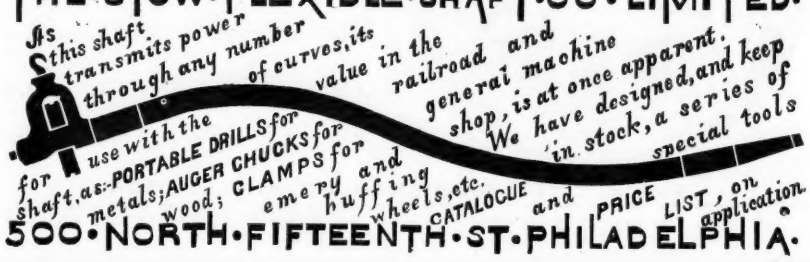
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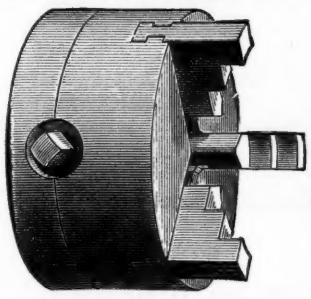

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One	"	18 in. by 10 ft.	Wheeler.
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One	"	13 in. x 5 ft.	
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One	"	30 in. x 30 in. x 6 ft.	Wheeler.
One	"	33 in. x 30 in. x 16 ft.	"
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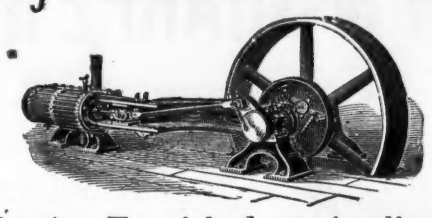

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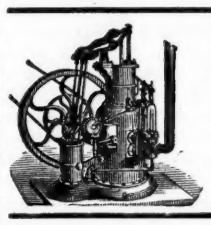

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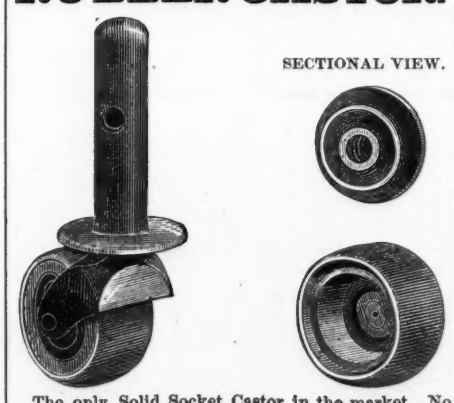

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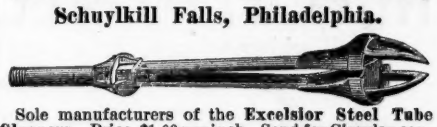

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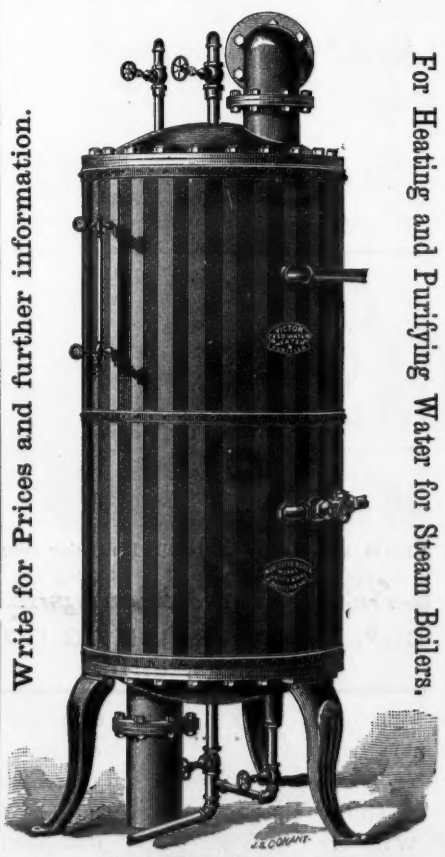

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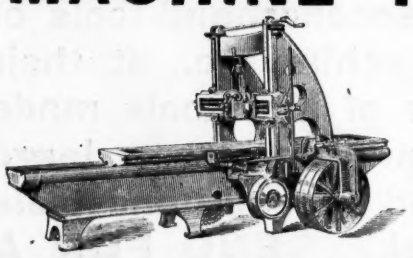

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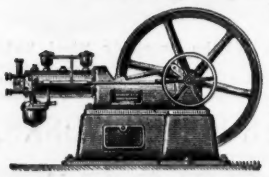

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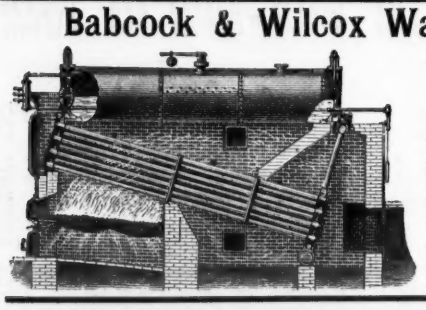

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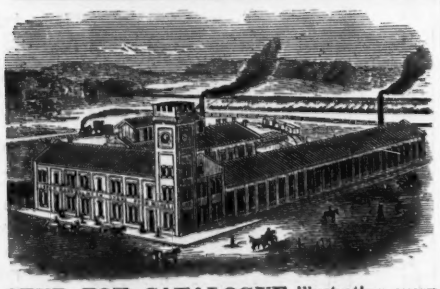

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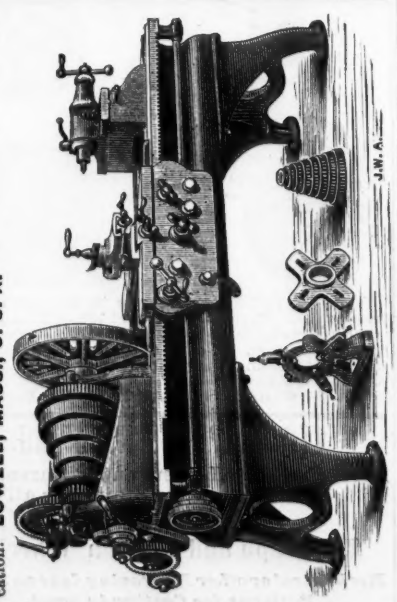

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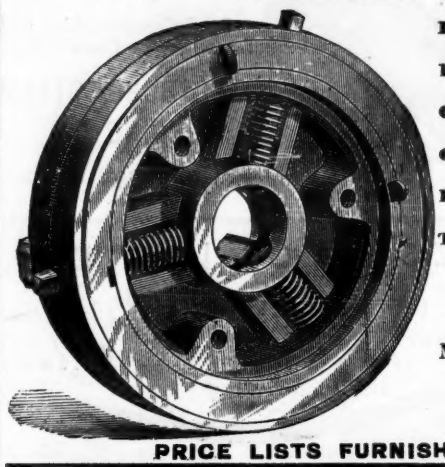

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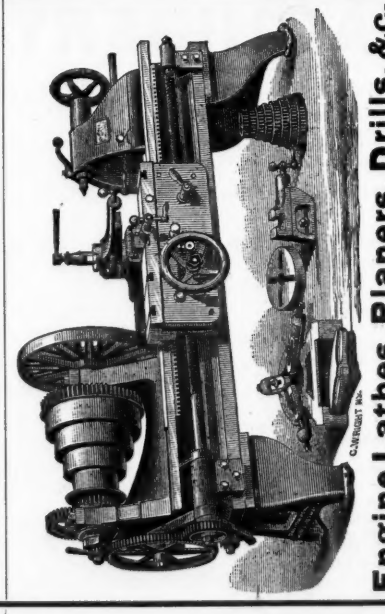

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